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Building Code Requirements for New Dwelling Construction

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Building Code Requirements for New Dwelling Construction

Recommended by the National Housing Agency
and Prepared in Consultation With the
National Bureau of Standards

ISSUED JANUARY 1, 1947

Building Materials and Structures Report BMS107

Superseding BMS88

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Foreword

A great deal is said and written about the need for increasing the supply of housing and for reducing its cost. The regulations imposed by local authorities in the interest of safety and health necessarily are a factor in the situation. In this publication the National Housing Agency, with the cooperation of the National Bureau of Standards, has recorded its views on what constitutes reasonable building code requirements for dwellings. These requirements have as their base a number of standards that have been developed by representative committees. Where specialized experience in the housing field has made it seem advisable to make additions, modifications, or exceptions to these basic standards, this has been done. The aim has been to provide sound construction without excessive cost and with adequate provision for recognizing new developments in the building field as they occur.

E. U. Condon, *Director.*

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Building Code Requirements for New Dwelling Construction

Recommended minimum requirements for dwelling construction, developed by the National Housing Agency in consultation with the National Bureau of Standards, are presented for consideration by local authorities in revising their building codes. The requirements are based on an earlier publication "Recommended Building Code Requirements for New Dwelling Construction," which has been revised in the light of suggestions from governmental housing agencies, the Forest Products Laboratory, and many industrial organizations. They make free use of national standards, with such additions, modifications, and exceptions as the experience of the housing agencies has demonstrated to be advisable in the case of dwelling construction. An appendix supplies information intended to be helpful in applying and interpreting the provisions of the requirements themselves.

INTRODUCTION

The suggested building code requirements for dwellings in this report are a revision of earlier requirements prepared by a subcommittee of the Central Housing Committee, which has now been discontinued. Coordination of housing activities of the Federal Government is now effected through the National Housing Agency, which has an interest in good building regulations both as they affect the speedy completion of adequate housing for veterans and as they bear upon the general problem of assuring adequate safety for the occupants of dwellings erected as part of a long-time housing program. In order to bring the earlier requirements up to date the Agency has sponsored this revision, which has been prepared in cooperation with the National Bureau of Standards. It has sought the advice of other Federal agencies, has drawn upon the resources of its own staff and of its constituent members, and has given consideration to many suggestions received as a result of an invitation extended to nongovernmental bodies to offer criticism on drafts of proposed requirements.

As in the previous edition, much reliance is placed upon existing standards. These have been prepared by representative bodies after full consideration of results of research and after extended discussion by persons of long experience. They are also readily available. The principle followed in preparing this Code has been to require generally accepted good practice and then to recognize conformity to certain well-developed standards as acceptable evidence of such practice. This does not mean that other methods of construction are forbidden, but the burden of proof is placed upon those who propose to build otherwise to show through test results and other information that their proposals will provide adequate safety. Additions, modifications, and exceptions to the designated standards have been given in the requirements when the experience of Federal agencies engaged in housing work appeared to justify it. It is hoped that this method of treatment will provide an acceptable basis for the ordinary case, while allowing sufficient flexibility to take care of any alternate methods that may have merit.

The standards cited as acceptable good practice in the Code are identified by title and year of adoption by the sponsoring agency to make certain just what requirements must be observed. In order to keep the Code up to date, however, it is important that advantage be taken of any later editions of the standards that may appear. For this purpose the building official should ascertain annually what new editions are available and recommend to the local legislative body that the references in the Code be changed to cover these later standards.

To assist the user of the Code in ascertaining specifically what is required in the more usual situations encountered, detailed features pertaining to residential construction consistent with the reference standards are presented in an appendix. These may be converted into mandatory language and included in local codes if this method is preferred. The appendix also contains useful information intended to assist in applying the Code requirements.

It is anticipated that in most cases the suggested requirements will form part of, or supplement, an existing code which already contains provisions pertaining to all buildings on such matters as types of construction, allowable areas between fire walls, roofing, and other features. Pending the time when generally acceptable good practice is embodied in national standards on these topics, no recommendations are made concerning them, it being assumed that the local code will be followed.

One point was emphasized in the previous report and deserves repetition here. Building code requirements can be legally effective only when they call for the minimum that is necessary for safety and health. This places them in a different class from other standards, which properly take into consideration expected life, comfort, livability, good taste, and other matters that are socially and economically desirable but cannot be legally required. An appreciation of the distinction should help to clear up some of the confusion that exists regarding apparent inconsistencies between building standards and building code requirements.

When the National Housing Agency undertook the responsibility for this undertaking it asked the National Bureau of Standards to cooperate in the study of available material and in the drafting of revised provisions that would reflect developments in research and standardization since the publication of the earlier report. The Bureau has continued to cooperate through the period of preparation. The Forest Products Laboratory of the United States Department of Agriculture has been especially helpful in connection with questions regarding wood construction. Many individuals both within the National Housing Agency and in its constituent agencies have participated in the work.

The recommended requirements in this report are presented as suitable for consideration wherever local building code requirements for dwellings are being adopted or revised. It is believed that such a document can provide a continuing service through which the experience of Federal agencies and the results of Federal research can be made continuously available to local governmental authorities. Periodical revision is planned; and criticism and suggestions for improvement are invited.

CHAPTER I. GENERAL[2]

Section 100. Scope

The requirements of this Code apply to dwellings, not over 2½ stories in height when containing one or two dwelling units, and not over 2 stories in height when containing more than two dwelling units, and accessory structures (such as garages) hereafter erected.

Section 101. Violations Unlawful

It shall be unlawful to construct or add to a dwelling or accessory structure in violation of the provisions of this Code.

Section 102. Materials and Methods Not Specifically Authorized

1. General

The provisions of this Code are not intended to prevent the use of any material or construction not specifically authorized by this Code provided any such alternate has been approved.

2. Approval

The building official shall require sufficient evidence to substantiate any claims that may be made regarding the use of such material or construction and shall approve them provided he finds that for the purpose intended the proposed design and the material, method, or system meets the requirements of this Code for safety and health.

3. Installation

Materials and constructions which have been approved shall be used and installed in accordance with the terms of approval. All such approvals and the conditions under which they are issued shall be reported and kept on file, open to public inspection.

4. Prefabricated Assemblies

Where the component parts of prefabricated assemblies are not readily accessible to inspection at the site, the building official may require certification that the assembly as installed at the site is identical with specimens upon which approval was based. If mechanical and electrical equipment is so installed as not to be readily accessible to inspection at the site certification may be required that such equipment complies with applicable laws and ordinances.

5. Tests Required

Whenever there is insufficient evidence that any material or construction conforms to the requirements of this Code, or there is insufficient evidence to substantiate claims for alternate materials or constructions, the building official may require tests as proof of compliance to be made at the expense of the owner by an approved agency.

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[2] In municipalities and areas where there is no building code, it is recommended that the provisions of American Standard Administrative Requirements for Building Codes—A55.1–1944, approved by the American Standards Association, form the basis for local requirements concerning powers and duties of the building official, method of obtaining permits, and other administrative matters, except as these provisions may be modified by this chapter. A revision of this standard is in process; inquiry should be made as to its availability. (See Appendix, par. 100.)

6. *Test Procedure*

Tests shall be made in accordance with generally recognized standards for the material or construction in question, but in the absence of such standards the building official shall specify the test procedure. Duly authenticated tests by a competent person or laboratory may be accepted by him in lieu of tests under his own supervision.

7. *Record of Tests*

Copies of the results of all such tests shall be kept on file in the office of the building official for a period of not less than five years after the acceptance of the structure or materials or assembly of materials.

8. *Retesting*

The building official may require tests to be repeated, if at any time there is reason to believe that a material or construction no longer conforms to the requirements on which its approval was based. (See Appendix, par. 102.)

Section 103. SECOND-HAND MATERIALS

Second-hand materials may be used provided they comply in quality with requirements for materials in this Code. Masonry units shall be thoroughly cleaned before reusing. Structural members shall not be reused if so affected by previous use as to impair their usefulness for the purpose intended.

Section 104. PRIVATE WATER AND SEWAGE-DISPOSAL SYSTEMS

Prior to occupancy, a certificate of inspection to indicate compliance with acceptable practice shall be obtained by the owner or his agent from the State or local health official having jurisdiction in the case of all water and sewage-disposal systems not municipally owned and operated. Except as may be otherwise provided in law, in this Code, or in duly promulgated regulations, the Recommendations of the Joint Committee on Rural Sanitation contained in Rural Water-Supply Sanitation, Supplement No. 185 to the Public Health Reports; and in Rural Sewage Disposal, Reprint No. 2461 from the Public Health Reports, shall be deemed to be acceptable practice. (See Appendix, par. 104.)

CHAPTER II. DEFINITIONS

For the purpose of this Code, the terms listed below shall have the meanings given in this chapter.

Alley means a narrow supplementary thoroughfare for the public use of vehicles and pedestrians, affording access to abutting property.

Approved, as applied to a material, device, mode of construction, or testing agency, means approved by the building official under the provisions of this Code, or by other authority designated by law to give approval in the matter in question.

Basement means that portion of a building between floor and ceiling partly underground, but having less than half its clear height below the adjoining finished grade.

Bearing partition. (See *Partition, Bearing.*)

Bearing wall. (See *Wall, Bearing.*)

Building means an enclosed structure having exterior or party walls and a roof, designed for the shelter of persons, animals, or property.

Building official means the officer or other person charged with the administration and enforcement of this Code or his duly authorized representative.

Cavity wall. (See *Wall, Cavity.*)

Cellar means that portion of a building between floor and ceiling partly underground. but having half or more than half of its clear height below the adjoining finished grade.

Chimney. (See *Flue.*)

Common property line means a line dividing one lot from another.

Concrete, Plain.—"Plain concrete" means concrete cast in place without metal reinforcement or reinforced only for shrinkage or temperature changes.

Concrete, Reinforced.—"Reinforced concrete" means concrete in which reinforcement, other than that provided for shrinkage or temperature changes, is embedded in such a manner that the two materials act together in resisting forces.

Court means an open, unoccupied space bounded on two or more sides by the exterior walls of a building or by exterior walls and lot lines.

Court, Height.—"Height," as applied to a court, means the vertical distance from the level of the floor of the lowest story containing habitable rooms served by that court to the top of the walls bounding the court. In case the tops of such walls are at different elevations, the measurement shall be taken to the average elevation of the two highest walls that are opposite.

Court, Inner.—"Inner court" means a court enclosed on all sides by exterior walls of a building or by exterior walls and lot lines on which walls are allowable.

Court, Length.—"Length," as applied to an *outer* court, means the mean horizontal distance between the open and closed ends of the court.

Court, Outer.—"Outer court" means a court enclosed on not more than three sides by exterior walls of a building or by exterior walls and lot lines on which walls are allowable, with one side or end open to a street, driveway, alley, or yard.

Court, Width.—"Width," as applied to an *inner* court, means its least horizontal dimension. Width, as applied to an *outer* court, means the shortest horizontal dimension measured in a direction substantially parallel with the principal open end of such court.

Dead load. (See *Load, Dead.*)

Dwelling means a building designed or occupied as the living quarters for one or more families or households, usually equipped with cooking, bathing, toilet, and, where necessary, heating facilities.

Dwelling unit means a dwelling or a portion thereof providing complete living facilities for one family.

Faced wall. (See *Wall, Faced.*)

Fire-division wall. (See *Wall, Fire-division.*)

Fire door means a door construction consisting of door, frame, and sill, which under approved fire-test conditions meets the requirements for the location in which it is to be used.

Fire resistance means the period of resistance to standard exposure under the Standard Fire Test. (See Appendix, par. 800.)

Fire wall. (See *Wall, Fire.*)

Flue means a passage in a chimney through which smoke, gas, or fumes ascend. Each passage is called a flue; and one or more flues together with surrounding materials and jackets, when present, make up the chimney.

Grade.—"Grade," when used in connection with *lumber* for structural purposes, means a classification with respect to strength and suitability for use as a structural member.

Grade, Finished.—"Finished grade" means the line formed at the junction of a building and the area immediately surrounding the building to which the ground is to be or has been cut or filled.

Grade, Natural.—"Natural grade" means the surface of the ground prior to excavation.

Habitable room means a room designed to be used for living, sleeping, eating, or cooking, excluding bathrooms, toilet compartments, closets, halls, storage, and similar spaces.

Half story. (See *Story, Half.*)

Height, Court. (See *Court, Height.*)

Height, Story.—"Height," as applied to a *story*, means the vertical distance from the surface of a floor to the surface of the next floor above, or to the ceiling of the top story.

Height, Wall.—"Height," as applied to a *wall*, means the vertical distance to the top measured from the foundation wall, or from a girder or other immediate support of the wall.

Hollow wall. (See *Wall, Hollow.*)

Incombustible.—"Incombustible," as applied to a material, means that the material will not ignite at or below a temperature of 1,200° F.

Lintel means a beam or girder placed over an opening in a wall or partition, which supports the construction above.

Load, Dead.—"Dead load" means the weight of walls, floors, roofs, partitions, and other permanent portions of the structure.

Load, Live.—"Live load" means any load other than the dead load.

Lot means a portion or parcel of land considered as a unit, devoted to a certain use or occupied by a building or a group of buildings that are united by a common interest or use, and the customary accessories and open spaces belonging to the same.

Lot line means a line dividing one lot from another, or from a street or other public space.

Masonry means stone, brick, structural clay tile, concrete masonry units, gypsum tile or block, structural glass block, or other similar building units or materials, or a combination of same, bonded together with mortar. Masonry also includes plain concrete.

Multiple dwelling means a dwelling containing separate dwelling units for three or more families, with joint services or facilities or both.

Nonbearing partition. (See *Partition, Nonbearing.*)

Nonbearing wall. (See *Wall, Nonbearing.*)

Occupied shall be construed as though followed by the words "or intended, arranged, or designed to be occupied."

Partition, Bearing.—"Bearing partition" means an interior bearing wall one story or less in height.

Partition, Nonbearing.—"Nonbearing partition" means an interior nonbearing wall one story or less in height.

Party wall. (See *Wall, Party.*)

Pier means an isolated column of masonry. A bearing wall not bonded at the sides into associated masonry shall be considered a pier when its horizontal dimension measured at right angles to the thickness does not exceed four times its thickness.

Plain concrete. (See *Concrete, Plain.*)

Property line, Common. (See *Common property line.*)

Public, as applied to a hallway or stairway, means used in common by two or more families.

Reinforced concrete. (See *Concrete, Reinforced.*)

Room, Habitable. (See *Habitable room.*)

Shaft means an enclosed shaftway or space, extending through one or more stories of a building, connecting a series of two or more openings in successive floors, or floors and roof.

Solid masonry wall. (See *Wall, Solid Masonry.*)

Standard Fire Test means the fire-test procedure formulated and published by the American Society for Testing Materials under the title of "Standard Methods of Fire Tests of Building Construction and Materials." (See Appendix, par. 800.)

Story means that part of a building comprised between a floor and the floor or roof next above wherein 75 percent or more of the clear floor area has the minimum height established for habitable rooms. (See *Basement.*)

Story, Half.—A "half story" is one wherein less than 75 percent of the clear floor area under the roof next above has the minimum height established for habitable rooms. An unfinished space immediately under a roof of a multiple dwelling shall not be considered a half story.

Street means a highway or thoroughfare dedicated or devoted to public use by legal mapping, user, or other lawful manner; and includes avenue, road, alley, lane, boulevard, terrace, concourse, driveway, and sidewalk.

Structure means a combination of materials forming a construction having more or less permanent location.

Veneered wall. (See *Wall, Veneered.*)

Wall, Bearing.—"Bearing wall" means a wall which supports any vertical load in addition to its own weight.

Wall, Cavity.—"Cavity wall" means a wall built of masonry units or of plain concrete, or a combination of these materials, so arranged as to provide an air space within the wall, and in which the facing and backing of the wall are tied together with metal ties.

Wall, Common-property-line.—"Common-property-line wall" means a wall along a property line against which a wall can be built on the adjoining property.

Wall, Faced.—"Faced wall" means a wall in which the masonry facing and backing are so bonded as to exert common action under load.

Wall, Fire.—"Fire wall" means a wall of incombustible materials, which subdivides a building or separates buildings to restrict the spread of fire, by starting at the foundation and extending continuously through all stories to or above the roof.

Wall, Fire-division.—"Fire-division wall" means a wall which subdivides a building to restrict the spread of fire, but is not necessarily continuous through all stories nor extended through the roof.

Wall, Hollow.—"Hollow wall" means a wall built of masonry units so arranged as to provide an air space within the wall, and in which the facing and backing of the wall are bonded together with masonry units.

Wall, Nonbearing.—"Nonbearing wall" means a wall which supports no vertical load other than its own weight.

Wall, Party.—"Party wall" means a wall used or constructed to be used jointly by two parties under easement agreement and erected at or upon a line separating two parcels of land that may be held under different ownership.

Wall, Solid Masonry.—"Solid masonry wall" means a wall built of solid masonry units laid contiguously with the joints between the units filled with mortar or a wall consisting of plain concrete.

Wall, Veneered.—"Veneered wall" means a wall having a masonry facing which is attached to the backing but not so bonded as to exert common action under load.

Yard means an open, unoccupied space on the same lot with the building between the lot line and the extreme front, rear, or side wall of the building.

Yard, Front.—"Front yard" means a yard across the full width of the lot, extending from the front line of the building to the front line of the lot.

Yard, Rear.—"Rear yard" means a yard across the full width of the lot, extending from the rear line of the building to the rear line of the lot.

Yard, Side.—"Side yard" means a yard extending from the front yard or front lot line to the rear yard or rear lot line, from the side line of the building to the side lot line.

CHAPTER III. GENERAL BUILDING LIMITATIONS

Section 301. ZONING RESTRICTIONS

Nothing in this Code shall be construed to lower in any way existing zoning requirements. If the requirements of this Code are more restrictive than existing zoning requirements, then this Code shall govern.

Section 302. Limitations

1. Height

No dwelling having exterior walls of wood construction shall exceed 35 feet or 2½ stories at any point above finished grade. (See Appendix, par. 302–1.)

2. Building Lines

Except as specifically permitted in law or regulations, no dwelling or accessory structure shall be so located that any part extends beyond established building lines.

Section 303. Party Walls [3]

Party walls shall be designed as bearing walls capable of carrying safely any loads which may be imposed from both sides; and shall be so constructed that a dwelling unit on either side may be razed without impairment of structural stability of the wall. (See sec. 801–2.)

CHAPTER IV. LIGHT AND VENTILATION

Section 400. General

Every dwelling shall be provided with windows or with equivalent means of supplying light and ventilation which shall conform to generally accepted good practice. Except as may be otherwise provided in law, in this Code, or in duly promulgated regulations, the American Standard Building Code Requirements for Light and Ventilation A53.1–1946, approved by the American Standards Association, shall be deemed to be generally accepted good practice. (See Appendix, par. 400.)

Section 401. Skylights

Skylights shall not be permitted for lighting or ventilation in habitable rooms.

Bathrooms may be ventilated by skylights when located immediately under a roof.

Ventilating skylights shall be arranged with the sides extended above the roof and there provided with hinged glazed sash having an area not less than that required for openable parts of windows, or they may be arranged with fixed incombustible louvered sides having the required openable area and a pivoted glazed sash at the ceiling line.

Section 402. Screening

When deemed necessary by the local health authorities, dwellings shall be effectively screened. (See Appendix, par. 402.)

CHAPTER V. SPACE AND ARRANGEMENT

Section 500. General

Every dwelling shall be so designed as to conform in height, area, and arrangement of rooms to generally accepted good practice. Except as may be otherwise provided in law, in this Code, or in duly promulgated regulations, the American Standard Building Code Requirements for Light and Ventilation A53.1–1946, approved by the American Standards Association, shall be deemed to be generally accepted good practice. (See Appendix, par. 500.)

CHAPTER VI. EXITS

Section 600. General

Multiple dwellings shall be provided with exit facilities which shall conform to generally accepted good practice. Except as may be otherwise provided in law, in this Code, or in duly promulgated regulations, the American Standard Building Exits Code A9.1–1946, approved by the American Standards Association, shall be deemed to be generally accepted good practice. (See Appendix, par. 600.)

Section 601. Number of Exits

Every floor of a multiple dwelling and every floor area enclosed by fire and exterior walls shall have not less than two exits; provided that one exit may be permitted when no entrance door of a dwelling unit is distant more than 20 feet from a door opening into an exit stairway or from the top riser of such stairway.

Section 602. Location of Exits

Exits shall be so located that the distance from the entrance door of a dwelling unit to an exit shall not exceed 60 feet; provided that no such door located on a dead-end hallway shall be more than 20 feet from an exit.

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[3] The municipality or agency using this Code should examine the statutes, ordinances, or other regulations pertaining to party walls in the community for correlation therewith. The recommendations in this Code incorporate only minimum requirements, considered essential to health and safety to life. Some authorities contend that the mutuality of ownership inherent in a party wall should impose additional construction requirements. Presented below is the suggested wording for an additional code requirement based on this contention:

> Party walls shall be of masonry, or of other incombustible material; they shall bear on foundations of the same type and construction as exterior wall foundations; they shall extend through the roof.

Section 603. STAIRWAYS

1. Width

No stairway serving as an exit shall have a width of less than 36 inches.

2. Enclosures

Required stairways shall be enclosed with construction having a fire resistance of at least three-fourths hour. Stairways extending into basements and cellars shall be provided with approved self-closing metal-clad doors or with 1¾-inch solid-core wood-slab doors.

3. Lighting and Ventilation

Required stairways shall be provided with ventilating skylights, windows on an exterior wall glazed with plain glass, or a plain glass skylight with a metal screen below the glass. The open or openable area shall be at least 6 square feet.

Section 604. HANGING OF DOORS

The doors of doorways serving as exits shall swing in the direction of exit travel and shall be so hung and arranged that they shall not obstruct the travel along an exit passageway, stairway, or other required exit, provided that a door swung flat against a wall is not considered an obstruction and, provided further, that no door shall at any point in its swing reduce the width of an exit stairway to less than 30 inches.

Section 605. PUBLIC HALLWAYS

1. Width

The width of a public hallway shall be at least equal to the width of the exit doorway to which it leads, but not less than 48 inches.

2. Enclosure

Public hallways shall be enclosed with construction having a fire resistance of at least three-fourths hour.

Doors in public hallways leading from the foot of stairways serving as exits to the outside of the building shall be approved self-closing fire doors or 1¾-inch solid-core wood-slab doors.

CHAPTER VII. CONSTRUCTION

Section 700. GENERAL

1. Quality of Materials

All building materials shall be of good quality, conforming to generally accepted standards. Except as may be otherwise provided in law, or in this Code, or in duly promulgated regulations, the specifications of the American Society for Testing Materials, or similar standards, such as Federal Specifications, standards of the American Standards Association, or Commercial Standards promulgated by the United States Department of Commerce through the National Bureau of Standards, shall be deemed to be generally accepted standards. (See Appendix, par. 700–1.)

2. Details and Connections

All members shall be so framed, tied, and braced as to develop the strength and rigidity necessary for the purposes for which they may be used. No member shall be stressed in excess of the strength of its details and connections.

3. Design and Workmanship

Design of structural members, and workmanship in the fabrication and preparation of materials and in their installation, shall conform to generally accepted good practice. The entire structural frame and each member which is a part of such frame shall be so designed and constructed that the stresses may be satisfactorily determined by rational analysis in accordance with well-established principles of mechanics; or satisfactory evidence of safety shall be provided the building official in accordance with the requirements of Section 102. Specific provisions of this chaper shall be controlling but shall not be deemed to suspend other requirements of good practice which shall be regarded as supplementing such specific provisions. Except as may be otherwise provided in law, or in this Code, or in duly promulgated regulations, the standards of Federal or State agencies, national technical organizations and standardization bodies, or fire underwriters shall be deemed to be generally accepted good practice.

Section 701. ALLOWABLE STRESSES

1. *General*

Dwellings and accessory structures shall be so designed that the safe working stresses of the materials used are not exceeded.

2. *Increases*

Higher stresses than specified in the standards to which reference is made in this Code may be used, but only if it is clearly established, by test or other satisfactory evidence, that material of a higher grade or a superior workmanship than is generally provided in ordinary good practice is to be employed. The use of higher stresses, however, shall not be allowed until a statement, giving the reasons for such permission together with the facts and circumstances on which it is based, is placed on file and made a part of the official record of the permit.

Section 702. LOADS

1. *Design*

All parts of dwellings and accessory structures shall be designed to support safely their own weight and all other loads to which they may be subjected.

2. *Floor Loads*

The minimum load to be assumed as caused by the occupancy for design of floors shall be not less than 40 lb/ft ^{2} uniformly distributed, provided that, for upper floors of single-family dwellings, the load may be reduced to 30 pounds in designing floor joists for flexure.

Where attics are to be used for light storage, a live load of not less than 20 lb/ft^2 shall be assumed on ceiling joists. Where no provision is made for attic storage, no live load need be assumed on ceiling joists. (See Appendix, par. 709–1.)

The total load to be used in designing girders shall include the dead load of floor, ceiling, and partition constructions plus the combined dead and live load of the roof plus 50 percent of the assumed live loads of floors and ceilings; but no reduction of live load shall be made unless the girder carries 90 or more square feet of floor area. Supporting columns, bearing walls, and footings shall be designed for the same reduction of live load as permitted above for the girders that bear on them.

3. *Loads on Exterior Walls*

Vertical faces of dwellings and accessory structures shall be capable of withstanding a horizontal load of not less than 15 lb/ft ^{2} acting inward or outward.

4. *Live Loads on Roofs (Including Snow and Wind Loads)* [3a]

(a) Roofs, either flat or pitched, with angles of slope up to and including 40 degrees shall be designed to withstand an inward load of not less than 20 lb/ft ^{2} of horizontal projection.

(b) Pitched roofs with slopes greater than 40 degrees shall be designed to withstand an inward load of not less than 12 lb/ft ^{2} normal to the roof surface.

(c) Roofs, either flat or pitched, shall be designed to withstand an outward load of not less than 15 lb/ft ^{2} normal to the roof surface.

(d) Whenever increases in stresses are permitted for combinations of loads on roofs, the section found shall be at least as strong as that obtained by the use of the minimum loads given above together with the normal allowable stress for the material concerned.

5. *Design Computations and Test Data*

Where construction and provision for anchorage is satisfactory to the building official, submittal of design computations or test data may be waived by him.

6. *Anchorage*

Adequate anchorage of roofs to walls and columns, and of walls and columns to foundations, shall be provided to resist safely vertical lifting forces and to prevent any sliding or overturning.

Section 703. SOIL-BEARING CAPACITY

1. *Safe Capacity*

Where the bearing capacity of the soil is not definitely known, the building official may require load tests or other proof as to the permissible safe bearing capacity at the particular location.

2. *Varying Soil Conditions*

In case a dwelling or accessory structure rests partly on rock or hardpan and partly on some other soil, measures shall be taken to equalize settlement.

[3a] These requirements are minimum. In preparing local codes, larger figures should be substituted where necessary. (See Appendix, par. 702.)

3. Filled Ground

No dwelling or accessory structure shall be placed upon filled ground until the building official has fixed by test the safe bearing capacity that may be assumed.

4. Clearing of Building Site

All stumps and roots shall be removed from the soil for a distance of 12 inches around and beneath the space to be occupied by the dwelling or accessory structure.

5. Protection of Adjoining Property

Except as may be otherwise provided in law, excavations made to a depth of 12 feet or less below established grade shall be so protected that the soil of adjoining property will not cave in or settle, but the expense of underpinning or extending the foundations of buildings or other structures on adjoining properties shall be borne by the adjoining property owner. For excavations in excess of 12 feet below established grade, all expenses of any nature incurred by the adjoining property owner in protecting his property shall be borne by the party causing the excavation to be made.

Section 704. FOUNDATIONS

1. Required

All dwellings or accessory structures shall have foundation walls or piers, except when supported by concrete slabs whose design is approved by the building official.

2. Depth

Except when erected upon solid rock, foundation walls or piers shall be carried below frost line and not less than 12 inches below natural grade, provided that this requirement shall not apply to structures other than dwellings having exterior walls of light metal or wood construction not over one story in height and not more than 400 square feet in area.

3. Frozen Ground

No dwelling or accessory structure shall be built upon frozen ground.

4. Footings

(*a*) *Materials.*—Footings of walls, columns, and piers shall consist of plain concrete, reinforced concrete, or masonry of solid units when approved by the building official, provided that footings of wood may be used if they are entirely below permanent water level or subjected to a preservative treatment by pressure-processing conforming to good practice. (See Appendix, par. 704.)

(*b*) *Design.*—Footings of walls, chimneys, piers, and columns shall be of dimensions to maintain a safe load on the soil and shall be so designed that the pressure on the soil per unit of area shall, so far as practicable, be uniform under all parts of the building or structure. Footings shall rest on level solid ground or rock. Whenever excavation for footings is carried below the planned depth, the space so excavated, below the proposed footings, shall be filled solidly with concrete. The maximum projection of a footing shall be one-half of its depth unless reinforcement is provided to resist bending.

5. Pile Foundations

Piles intended to sustain walls or buildings shall be of wood, reinforced concrete, steel shells filled with concrete, or other approved types. So far as practicable, they shall be driven to a solid bearing; or they shall be driven to provide adequate support in accordance with good engineering practice. The method of driving shall be such as not to impair their strength.

Wood piles shall be sound and straight timber. Piles and capping timbers or portions thereof, which are not placed below permanent water level, shall be pressure-treated in conformance with good practice. (See Appendix, par. 704.) Piles and capping timbers or portions thereof shall not extend within 12 inches of the ground surface.

The safe bearing capacity of piles shall be determined by an approved formula or by test. When doubt exists as to the safe bearing capacity of piles upon which a dwelling or accessory structure is to be supported, the building official may order a test to be made.

6. Foundation Walls

(*a*) *General.*—Foundation walls shall conform to generally accepted good practice. Except as may be otherwise provided in law, in this Code, or in duly promulgated regulations, the requirements for Foundation Walls contained in the American Standard Building Code Requirements for Masonry A41.1–1944, approved by the American Standards Association, shall be deemed to be generally accepted good practice. (See Appendix, par. 704–6.)

(*b*) *Height above ground.*—Foundation walls supporting wood or light steel structural members shall extend at least 6 inches above the finished grade. (See also sec. 709–9 (f).)

(*c*) *Waterproofing.*—Foundation walls of basements and cellars shall be made watertight.

(*d*) *Drainage.*—When the surface of the ground beneath a building having no basement or cellar is below the outside finished grade, adequate provision shall be made for draining any space beneath the building.

(*e*) *Protection against lateral pressure.*—When the character of soil makes it necessary, the building official may require pilasters, buttresses, or additional wall thickness to guard against the result of lateral pressure. He may also require the installation of drain tile around footings to carry ground water away from the structure.

Section 705. MASONRY

1. General

Masonry shall conform to generally accepted good practice. Except as may be otherwise provided in law, in this Code, or in duly promulgated regulations, the American Standard Building Code Requirements for Masonry A41.1–1944, approved by the American Standards Association, shall be deemed to be generally accepted good practice. (See Appendix, par. 705.)

Section 706. REINFORCED CONCRETE

1. General

Reinforced concrete shall conform to generally accepted good practice. Except as may be otherwise provided in law, in this Code, or in duly promulgated regulations, the Building Regulations for Reinforced Concrete (ACI 318–41) of the American Concrete Institute, approved by the American Standards Association as American Standard Building Regulations for Reinforced Concrete A89.1–1946, shall be deemed to be generally accepted good practice. (See Appendix, par. 706.)

2. Mix

Concrete for reinforced concrete shall consist of 1 part of portland cement to not more than 6 parts of aggregate, either in the proportion of 1 part of cement, 2½ parts of sand, and 3½ parts of coarse aggregate, measured dry by volume, and not more than 7½ gallons of water per sack of 94 pounds of cement; or in such other proportion that the crushing strength at 28 days shall be not less than 2,000 pounds per square inch.

3. Walls

(*a*) *Anchoring.*—Enclosure walls of reinforced concrete shall be securely anchored at all floors. Such walls when supported by girders at each story shall be bonded or otherwise securely tied to columns or piers.

(*b*) *Thickness.*—Bearing walls shall be not less than 6 inches in thickness.

Panel and enclosure walls shall have a thickness of not less than 5 inches and not less than one-thirtieth the distance between the supporting or enclosing members.

Exterior basement and cellar walls, foundation walls, and fire walls shall be not less than 8 inches thick, provided that foundation walls may be 6 inches thick wherever they support walls that are permitted to be of that thickness or less.

Section 707. REINFORCED BRICK MASONRY

1. General

Reinforced brick masonry shall conform to generally accepted good practice. (See Appendix, par. 707.)

Section 708. STEEL AND IRON

1. General

Steel and iron construction shall conform to generally accepted good practice. Except as may be otherwise provided in law, in this Code, or in duly promulgated regulations, the American Standard Building Requirements for Structural Steel (Riveted, Bolted, or Welded Construction) A57.1–1943, approved by the American Standards Association, shall be deemed to be generally accepted good practice for structural steel. (See Appendix, par. 708.)

2. Light-Gage Steel Construction

Steel studs, or other steel structural members of hot-rolled or cold-formed steel, other than steel joists, having less thickness than called for in the standard referred to in Section 708–1 may be used either alone or in combination with other materials provided they are designed in accordance with generally accepted good practice and are capable of supporting all loads, including wind loads, without exceeding allowable stresses. Allowable stresses for members of steel equal in quality to structural steel shall be the same as for that material. For members of steel different in quality, allowable stresses shall be modified as required by the building official. (See Appendix, par. 708.)

3. Steel-Joist Construction

Steel-joist construction shall conform to generally accepted good practice. (See Appendix, par. 708.)

Field welding shall be done only when approved by the building official. (See Appendix, par. 708.)

4. Miscellaneous Requirements

(*a*) *Thickness.*—The thickness of all steel members in places exposed to dampness, including crawl spaces, shall be not less than 16 gage.

(*b*) *Protection.*—Steel studs, joists, and all other steel members shall be given one shop coat of approved paint. All members exposed to dampness shall be given a second coat in the field.

Section 709. WOOD CONSTRUCTION

1. General

All wood structural members shall be of sufficient size and strength, and of such quality, and so conditioned and used as to carry their imposed loads safely.

Except as may be otherwise provided in law, in this section, or in duly promulgated regulations, the principles set forth in the Wood Handbook of the United States Department of Agriculture, 1940, shall be deemed to be good practice in the design of wood construction.

Adequate fastening shall be provided at the intersections of wood structural members and at other points specifically designated in this section. (See Appendix, par. 709-1.)

2. Sizes of Lumber

American Lumber Standard dressed sizes shall be accepted as the minimum net sizes conforming to nominal sizes.[4] For convenience, nominal sizes may be shown on the plans. (See Appendix, par. 709-2.)

3. Wood Posts

Wood posts when used as columns in basements or cellars shall bear on concrete bases extending not less than 3 inches above the finished floor. The base shall bear directly on the post footing. When the floor is not of concrete or other solid material impervious to termites, concrete bases for wood posts shall extend not less than 6 inches above the finished floor.

4. Splicing

Structural framing members shall not be spliced between bearing points unless approved by the building official.

5. Exterior Walls

(*a*) *Load-carrying capacity.*—Exterior walls shall be designed to carry safely all loads as specified in Section 702. (See Appendix, par. 709-5 (a).)

(*b*) *Sheathing.*—Exterior walls not having diagonal wood sheathing shall have diagonal bracing at all corners. Such other measures as may be necessary shall be taken to secure rigidity.

Wood sheathing boards shall be not less than 6 inches in width and shall be nailed with not less than two eightpenny nails to each stud for boards up to 8 inches wide and with three nails for wider boards. Other forms of sheathing shall be nailed as required by the building official. (See Appendix, par. 709-1.)

Sheathing shall be nailed to top and bottom plates and to sills. (See Appendix, par. 709-1.)

In frame construction of 2 or 2½ stories where the studs are not continuous from sill to roof and diagonal sheathing is omitted, other sheathing or connections shall be provided so designed as to supply adequate structural continuity between first and second stories.

(*c*) *Masonry veneer on wood construction.*—Masonry veneer applied to the walls of frame construction shall rest directly upon the masonry foundation of the structure and shall be not less than 3¾ inches in thickness, unless otherwise approved by the building official.

Waterproof flashing shall be installed when necessary to prevent moisture from penetrating behind the veneer.

Masonry veneer shall be securely attached to the frame structure, at intervals of not more than 16 inches vertically and 24 inches horizontally, with corrosion-resistant nails or ties.

A waterproof covering[5] shall be securely attached to the framework of the structure back of the masonry veneer. (See Appendix, par. 709-5 (c).)

(*d*) *Stucco on wood construction.*—Waterproof flashing or other expedients that will prevent penetration of moisture behind the stucco shall be used wherever necessary.

Where sheathing is omitted, approved corner and wall bracing shall be used. If a wall is back-plastered, the plaster shall be of sufficient thickness to extend back between the studs a distance of not less than one-quarter inch. (See Appendix, par. 709–5 (d).)

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[4] See Simplified Practice Recommendation R16-39, Lumber: American Lumber Standards for Softwood Lumber, promulgated by the U. S. Department of Commerce through the National Bureau of Standards.

[5] For best results, a covering should be used that permits the passage of moisture in the form of vapor from the inside to the outside.

Metal reinforcement when used shall be of expanded metal fabric or wire fabric. Where sheathing is used, expanded metal fabric shall weigh not less than 2.5 pounds per square yard and wire fabric shall be either not smaller than 17 gage with openings not more than 2 inches in greatest dimension or shall be not smaller than 18 gage with openings not more than 1 inch in greatest dimension. Where sheathing is omitted, expanded metal fabric shall weigh not less than 3.4 pounds per square yard and wire fabric shall be not smaller than 16 gage, shall have openings not more than 2 inches in greatest dimension, and shall be provided with waterproof paper backing. All wire fabric shall be zinc coated after fabrication.

Metal reinforcement for stucco of any type shall be furred away from sheathing or building paper at least three-eighths inch at all points by the use of approved furring nails or devices or by suitable metal strips unless self-furring metal lath is used.

The thickness of stucco when applied on metal lath or similar reinforcement shall be at least 1 inch and the metal reinforcement shall be covered on the exposed face at least five-eighths inch.

(*e*) *Ribbon boards.*—Ribbon boards used to support joists shall be not less than 1 by 4 inches, shall be cut into the studs, and securely nailed with not less than two tenpenny nails to each stud. The ends of joists adjoining studs shall be securely spiked to the studs. Wood blocking shall be inserted at the ends of joists not adjoining studs.

(*f*) *Notching of studs.*—In bearing walls or partitions, no stud shall be cut more than one-third its depth to receive piping and duct work or for other purposes. If more depth is required, the width of studs shall be increased accordingly.

(*g*) *Plates.*—Plates in exterior walls used to support joists or rafters shall be double, with each piece not less than 2 inches thick and the same width as the supporting studs.

(*h*) *Framing over openings in bearing walls.*[6]—Lintels and trusses in 2- by 4-inch bearing stud walls shall have heights and spans designed in accordance with good engineering practice, provided that no lintel shall be less than the equivalent of two 2- by 4-inch members on edge.

(*i*) *Jambs in bearing walls.*—All window and door openings in bearing walls shall have studs doubled on jambs. Such studs may be separated when effectively blocked to act as a unit. The inner stud may be cut to receive the lintel or header over the opening but shall extend in one piece from lintel or header to bearing.

6. *Interior Partitions*

(*a*) *Load-carrying capacity.*—Walls shall be designed to carry safely the full dead and live loads. (See Appendix, par. 709–5 (a).)

(*b*) *Plates.*—In 2- by 4-inch stud construction the bearing partitions shall be provided at the top with double plates, each not less than 2 inches thick and the same width as the studs. When the joists are placed directly above each stud, a single top plate may be used, provided that joints in the plate are properly spliced to form a continuous tie and the ends are tied to adjacent walls. If properly firestopped, studs may run through the floor and shall rest on girders or on partition plates.

Partitions not resting upon girders or on partition plates below shall have sole plates of dimensions not less than that of the studs.

Partitions unsupported by walls shall be supported on girders or double joists or on sole plates if placed at an angle to the joists.

Nonbearing partitions of 2- by 3-inch or 2- by 4-inch stud construction shall be provided with at least one 2-inch plate on top and bottom, of same width as the studs, or be otherwise properly firestopped at floor lines.

(*c*) *Framing over openings in bearing partitions.*—Framing over openings in bearing partitions shall conform to the requirements in Section 709–5 (h) for framing over openings in bearing walls.

7. *Floors and Roofs*

(*a*) *Joists and girders.*—When supported by masonry, joists shall have ample bearing but not less than 3 inches.

Masonry walls shall be securely anchored to each tier of wood joists or wood beams bearing on them at maximum intervals of 6 feet in one- and two-family dwellings, and 4 feet in other buildings, by metal anchors having a minimum cross section of ⅛ inch by 1 inch, and at least 16 inches long, securely fastened to the joists or beams and provided with split and upset ends or other approved means for building into masonry. Girders shall be similarly anchored at their bearings. Anchors shall be attached in a manner to be self-releasing.

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[6] These requirements are based entirely on structural considerations. Attention should also be given to possible shrinkage effects due to the depth of the member. Where excessive shrinkage is indicated, resort should be had to trussing or other methods. (See Appendix, par. 709–5 (h).)

Masonry walls parallel to wood joists or to wood beams shall be provided with similar anchors at maximum intervals of 8 feet in one- and two-family dwellings, and 6 feet in other buildings, engaging three joists or beams. Upset and "T" ends on anchors shall develop the full strength of the anchor strap.

When enclosing walls are of wood, each joist, beam, and girder supported by the wall shall be securely spiked or anchored to the wall construction, so as to stay in place and to resist safely all lifts and lateral pressures required to be assumed by this Code.

Girders shall be fastened to each other where they intersect or abut, so as to resist safely a lateral force equal to the assumed wind pressure.

Floor joists framing into the side of wood girders shall be supported on metal joist hangers or on a bearing strip or ledger board on the side of the girders. Such strips or boards shall measure at least 2 by 3 inches. The notch in the end of the joist shall be not more than one-quarter of the joist depth, and the shearing stress shall not exceed the allowable stress when calculated in accordance with good engineering practice.

The ends of joists, whether resting upon girders or bearing partitions or abutted against the girders, shall be securely tied to the girders or to each other, so as to resist safely an outward thrust on the walls equal to the assumed wind pressure or the spreading action of the roof, whichever is the greater.

All joints of solid or built-up girders forming simple spans shall be made over column or pier supports. When continuous girders are made up of joists nailed together side by side, joints in adjoining joists shall be located between one-sixth and one-quarter the span length from an intermediate support, provided that no two adjoining joists nor more than one-half the total number shall be jointed on the same side of the support between the one-sixth and one-quarter points of the span.

Joists supporting nonbearing partitions which are parallel to the joists shall be doubled.

Joists shall not be notched within the middle one-half of the span. The top or bottom edges of joists may be notched in the outer one-quarter of the length, provided the notch does not exceed one-sixth of the joist depth.

(*b*) *Headers and trimmers.*—All headers and trimmers shall be doubled, except headers receiving not more than three tail beams and trimmers receiving a header with only one tail beam not over one-sixth of the joist span from the support. (See Appendix, par. 709–7 (b).)

(*c*) *Support of rafters.*—Rafters shall be vertically supported near the ridge when the slope is less than 4 inches per foot. Rafters, regardless of slope, shall be thus supported unless they are held from spreading. If the spread of the rafters is held by ties not at the plate line, the size of the rafters shall be increased to take care of the additional bending moments induced by the ties when the roof is loaded with the maximum vertical load. (See Appendix, par. 709–7 (c).)

Wood rafters shall be so spiked, or otherwise fastened to the plate or other members, as to resist safely all thrusts under full load and the upward lift, but not less than the equivalent of two sixteenpenny nails to each rafter end shall be used. (See Appendix, par. 709–1.)

(*d*) *Bridging.*—Floor and flat-roof joists and beams shall be securely bridged at intervals not exceeding 8 feet. (See Appendix, par. 709–7 (d).)

8. *Plank-and-Beam Construction*[7]

(*a*) *Design.*—Plank-and-beam construction shall conform to good engineering practice. (See Appendix, par. 709–8.)

(*b*) *Beams.*—The spacing of beams, center to center, shall in no case exceed 52 times the actual thickness of the plank flooring. Beams shall be not less than 3 inches, nominal dimension, thick and shall have a depth-width ratio of not more than 4, based on actual dimensions. When beams are built of two or more laminations, the depth-width ratio of a single lamination shall not exceed 6, based on actual dimensions.

Floor beams shall not be notched unless additional section is provided. Beams shall not bear over doors or windows without special provision for their support.

(*c*) *Plank.*—Plank shall be 2 inches or more in thickness and 6 inches or more in width, nominal dimensions, and shall be tongue-and-groove or splined.

The plank shall be laid at right angles to the supporting beams and shall be both blind- and surface-nailed. Planks which are continuous over two spans, or single-span planks which are distributed so that they do not occur in adjacent positions, may be used on spans not exceeding 52 times the actual thickness of the plank. Where it is necessary to have single-span planks in adjacent positions, the span shall not exceed 45 times the actual thickness of the plank.

(*d*) *Exterior-wall framing.*—Studs shall be spaced not more than 24 inches on centers. Floor, roof, and ceiling beams shall be supported at the exterior walls upon posts which are adequate to support the load and whose dimensions are not less than 4 by 4 inch, nominal size.

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[7] Plank-and-beam structural floor or roof system consists of plank subfloor or roof decking with supporting beams spaced up to 7 feet apart, instead of the usual boards for subfloor or roof decking with joists or rafters spaced the customary 12 to 24 inches.

(*e*) *Interior columns.*—Where beams abut over a column, a column dimension of not less than 8 inches parallel to the direction of the beams shall be used to provide suitable bearing for the beams. Basement columns shall have a cross section of at least 6 by 6 inches; those in other stories shall be at least 4 by 4 inches, all dimensions being nominal.

(*f*) *Fastenings.*—All structural members shall be adequately nailed to each other at their junction to provide a well-integrated structure. Girders shall be fastened to each other where they intersect or abut, so as to resist safely a lateral force equal to the assumed wind pressure.

9. *Plywood Construction*

(*a*) *Material.*—The term "plywood" as used in this section shall mean built-up board or piece of wood made of three or more layers of veneer joined with glue and so laid that the grain of adjacent plies is at right angles. An odd number of plies shall be used.

Plywood to be exposed to the weather or to severe conditions of service shall meet the requirements established for "Exterior Type" in Commercial Standard CS45–45, Douglas Fir Plywood. (See Appendix, par. 709–9 (a).)

Plywood for interior use above grade and not subjected to severe conditions of service shall meet the requirements established for the "Moisture Resistant Type" in Commercial Standard CS45–45 Douglas Fir Plywood. (See Appendix, par. 709–9 (a).)

(*b*) *Gluing plywood to framing members.*—If the units are for exterior walls or if the units will be subjected to severe conditions of exposure, the plywood shall be glued to the framing members with a glue conforming to one of the following specifications:

(1) Army Air Force specification 14124–A. Glue: Low-temperature-setting resin (phenol, melamine, and resorcinol base), 1945.
(2) Army Air Force specification 14139. Glue: High-temperature-setting resin (phenol, melamine, and resorcinol base), 1945.

If the units are for interior walls and ceilings subjected to normal conditions of service, the plywood shall be glued to the framing members with a glue conforming either to one of the specifications mentioned above or to one of the following specifications:

(1) Federal specification C–G–456; Glue; casein-type, water-resistant, 1941.
(2) Army Air Force specification 14122; Glue; water and mold resistant, casein, 1943.

Similar glue joints may be used for floor units if adequate ventilation beneath the house is provided. (See sec. 709–10 (d) and Appendix, par. 709–9 (b).)

(*c*) *Design of flat panel with stressed coverings.*—Design of flat panel with stressed coverings shall conform to good engineering practice. (See Appendix, par. 709–9 (c).)

(*d*) *Fastenings.*—All structural members shall be so connected at their junction as to provide a well-integrated structure.

The fastenings of panel coverings to longitudinal members by any means less rigid than gluing (such as nailing) shall not be considered as providing a stressed covering.

10. *Termites and Decay*

(*a*) *Site of building.*—Adequate surface drainage shall be provided at the building site.

(*b*) *Removal of debris.*—All wood debris shall be removed from the building site before construction is begun. No boards, stakes, or scraps of lumber shall be buried or left about the building.

(*c*) *Foundations.*—All foundations shall be made impervious to termites. If unit masonry is used it shall be capped with 4 inches of reinforced concrete or material providing an equivalent permanent barrier.[8]

(*d*) *Foundation wall vents.*—Adequate ventilation shall be provided beneath all wood construction over the ground so that no dead-air pockets exist.

For each area enclosed by exterior, fire, common-property-line, or party walls, the minimum net area of vent openings in the exterior walls shall be equal to one-half of 1 percent of the enclosed area plus one-half of 1 square foot for each 25 lineal feet of wall surrounding the area. When the building site is relatively wet at frequent periods, the area openings thus obtained shall be doubled.

(*e*) *Porches.*—Porches, steps, and terraces shall be insulated from the foundation and woodwork so as to prevent termites and moisture from gaining access to the building from the fill or space beneath the entrance platform. (See Appendix, par. 709–10.)

(*f*) *Closeness to ground.*—Except as permitted in Section 704–4 (a), no wood shall be placed in contact with the soil. Clearance under buildings without basements shall be not less than 18 inches below the bottom of all wood substructures, to allow crawl space for making inspections. Access doors or openings shall be provided.

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[8] Requirements concerning termites are intended only for those areas where is has been established that termite infestation exists. (See Appendix, par. 709–10.)

All wood used in basements, such as stair carriages, door frames, partitions, or posts, unless supported by a concrete floor at least 3 inches thick shall rest on poured-concrete plinths, pedestals, or curbs that extend above the general floor level for a distance of not less than 3 inches.

(*g*) *Girders in masonry or reinforced-concrete walls.*—Air spaces of ½ inch or more shall be provided around the ends of girders located below or near the grade line and which rest on masonry or reinforced concrete from which moisture may be absorbed, unless the girders are treated with an approved pressure preservative treatment or are made of all heartwood of one of the more decay-resistant species. (See Appendix, par. 709–10.)

(*h*) *Floor sleepers.*—Floor sleepers, furring strips, or other wood embedded in or laid on masonry or concrete that is in direct contact with the ground shall be the heartwood of a durable species or treated with an approved pressure preservative treatment. Pieces shall be completely framed before treatment whenever possible; but when cutting after treatment is unavoidable, the cut surfaces shall be given two brush coats of a suitable preservative. (See sec. 704–4 (a).)

(*i*) *Protection of material.*—Every other material consisting in whole or in part of cellulose shall be protected from termites and decay wherever wood is required to be so protected in this section.

(*j*) *Expansion joints.*—Expansion joints in floors and space around pipes penetrating floors and walls shall be sealed with coal-tar pitch, coal-tar plastic cement, or crimped metal connectors.

(*k*) *Water pipes.*—Water pipes located in basements shall be suspended so as to prevent absorption of condensation water by wood or other cellulose products.

(*l*) *Flashing over doors and windows.*—Adequate flashings shall be used over doors and windows to provide ready drainage of water.

(*m*) *Moisture in walls.*—When required by the building official, a vapor-resistant barrier shall be used at or near the inner face of the exterior walls and provision for ventilation of hollow spaces in such walls shall be made.

Section 710. Reinforced Gypsum Concrete

Except as may be otherwise provided in law, in this chapter, or in duly promulgated regulations, the American Standard Building Code Requirements for Reinforced Gypsum Concrete A59.1–1945, approved by the American Standards Association, shall be deemed to be generally accepted good practice. (See Appendix, par. 710.)

CHAPTER VIII. FIRE PROTECTION

Section 800. General

When construction is required to have a definite fire resistance, this shall be determined under the procedure set forth in the Standard Methods of Fire Tests of Building Construction and Materials, ASTM Designation C19–41 of the American Society for Testing Materials. (See Appendix, par. 800.)

The provisions of this chapter are minimum requirements for fire-protection purposes and shall not be deemed to reduce any other requirements of this Code, nor shall they be construed to reduce any zoning requirements that may apply.

Section 801. Fire Separation

1. Between Dwellings

Walls of dwellings or accessory structures that are less than 10 feet from another building or less than 5 feet from a common property line shall be unpierced and shall have a fire resistance of not less than 1 hour; provided that these distances may be reduced to 6 feet and 3 feet, respectively, in the case of accessory structures not over one story in height and not more than 400 square feet in area.

2. Between Dwelling Units

Walls, floors, and other construction separating dwelling units shall have a fire resistance of at least three-fourths hour. Such walls or partitions shall extend from the finished grade or from floor construction having a fire resistance of not less than three-fourths hour when over a common basement or cellar. When the attic space is or can be used for storage, they shall extend up to the under side of the roof sheathing; provided that when attic space cannot be used for storage and there is an incombustible finish on the ceiling of the top story, the walls or partitions may terminate at the ceiling of such story. (See Appendix, par. 801.)

3. Fire Walls

Fire walls shall be ground supported, and self-supporting in the event of collapse of adjoining construction on one side. They shall extend beyond the outer face of roof sheathing and beyond all walls having lower fire resistance than the fire walls. They shall penetrate roof construction and extend not less than 6 inches above it, provided that when such roof construction has a fire resistance of not less than three-fourths hour they shall be built up tightly to the under side of it.

4. Hazardous Spaces

Except in single-and two-family dwellings, boiler rooms, incinerator rooms, storage rooms for inflammable materials, and ash-storage rooms shall be enclosed by incombustible construction having a fire resistance of at least three-fourths hour. Openings into such enclosures shall be protected by approved self-closing fire doors.

5. Garages

When a garage for not more than two automobiles is located within a single- or two-family dwelling, the walls, partitions, and ceiling shall be protected on the garage side with an incombustible material not less than one half inch thick or with such an incombustible material not less than three eighths inch thick backed with tongue-and-groove boards not less than 1 inch in nominal thickness.

When a garage for more than two and not more than five automobiles is located within a dwelling, the floor construction above the garage and the walls and partitions enclosing it shall have a fire resistance of at least three-fourths hour.

When a garage for more than five automobiles is located within a dwelling, the floor construction above the garage and the walls and partitions enclosing it shall be of incombustible construction having a fire resistance of at least 1 hour.

When a garage is attached to a dwelling, the ceiling construction over the garage and the walls separating it from the dwelling shall be of construction conforming to that given above, according to the number of automobiles accommodated.

When a garage accommodates not more than five automobiles, openings from a dwelling into the garage shall be restricted to a single doorway provided with a self-closing door covered with metal on the garage side or a 1¾-inch solid-core wood-slab door. In the case of garages accommodating more than five automobiles, such openings shall be provided with approved self-closing fire doors. No glass shall be permitted in any door between a dwelling and a garage. The sill of such a door shall extend at least 7½ inches above the garage floor level.

Garage floors shall be of incombustible material.

Heating devices for garages shall be installed in approved separate heating rooms or shall be of an approved type installed approximately at the eave level or near the ceiling.

6. Business Separation

Construction of at least 1-hour fire resistance shall be provided between business and dwelling occupancies and between business occupancies and exits from dwellings.

Section 802. CONSTRUCTION AROUND CHIMNEYS AND FIREPLACES

1. Clearance from Chimneys

No combustible beams, joists, or rafters shall be placed within 2 inches of the outside face of chimneys or of masonry enclosing a flue, provided that this distance may be reduced to one-half inch when the members are faced to their full depth with asbestos insulating board or other approved insulating material not less than one-fourth inch thick. No combustible studding, lathing, furring, or plugging shall be placed against any chimney or in the joints thereof. Such combustible construction shall be set away from the chimney, or the plastering shall be directly on the masonry or on metal lath and furring or on other incombustible lathing and furring material. Combustible furring strips placed around chimneys to support base or other trim shall be insulated from the masonry by asbestos paper at least one-eighth inch thick, and metal wall plugs or approved incombustible nail-holding devices attached to the wall surface shall be used for nailing. Finished flooring shall be placed no closer than one-half inch to the chimney except as may be necessary at the corners for lateral support of the chimney. (See Appendix, par. 802–1.)

2. Removal of Wood Centering

Wood centering or forms under trimmer arches or hearths shall be removed after the masonry has set.

3. Clearance from Fireplaces

No combustible construction shall be placed within 4 inches of the back wall of any fireplace. Combustible or unprotected header beams supporting trimmer arches at fireplaces shall be not less than 20 inches from the face of the chimney breast.

No combustible mantel or other combustible construction or finish shall be placed within 4 inches of either side or 8 inches of the top of any fireplace opening, provided that no combustible mantel shelf shall be less than 12 inches above such opening.

Section 803. SEPARATION OF COMBUSTIBLE STRUCTURAL MEMBERS

A separation of at least 4 inches of solid masonry shall be provided in all masonry walls between combustible members which enter from opposite sides.

When unprotected steel or combustible structural members frame into hollow walls and cavity walls of thickness not greater than 12 inches, they shall project not more than 4 inches into the wall and shall be so spaced that there shall be a distance of at least 4 inches between the ends of such members entering from opposite sides of the wall. The space above, below, and between such members shall be filled solidly with burnt-clay materials, mortar, concrete, or equivalent fire-resistive material, to a depth of not less than 4 inches on all sides of the members.

Section 804. FIRESTOPPING

1. General

Firestopping shall be supplied at the locations specified in this section and shall be so arranged as to cut off all concealed draft openings and form an effectual fire barrier between stories and between the upper story and the roof space. (See Appendix, par. 804–1).

2. Exterior Walls

(*a*) *Wood construction.*—Exterior walls of wood construction shall be properly firestopped at each floor level and at the level where the roof rafters connect with the wall plate.

(*b*) *Furred spaces.*—For all masonry walls that are furred or studded off, the space created by the furring or studding shall be properly firestopped once in each story. Spaces around chimneys shall be firestopped with incombustible material.

3. Partitions

Where stud partitions rest directly over each other and the studs run down between the joists and rest on the top plate of the partition below, the spaces between the studding shall be properly firestopped.

4. Stairs

Except in one-family dwellings, the space under stairs built in whole or in part of combustible materials shall be left entirely open and kept clear and free from encumbrances.

The space between stair carriages shall be firestopped by a header beam at top and bottom. Where a stair run is not all in one room or where a closet is located beneath the stairs, the stair carriages shall have an intermediate firestop, so located as to cut off communication between portions of the stairs in different rooms, or between the closet and the room in which it is placed. Such stops shall be made of plank or other suitable material.

If a flight of stairs leading to the second story is over a flight of stairs leading to the basement or cellar, the stair construction to the second story shall have a fire resistance of at least three-fourths hour, provided that this shall not apply to stairways within individual dwelling units.

5. Pipes or Ducts

Where any pipe or duct passes through a floor, the space between the pipe or duct and the floor construction shall be firestopped.

Where the installation of pipes, ducts, or conduits in walls, floors, or partitions requires the removal of any firestopping, the spaces around the pipes, ducts, or conduits at such points where firestopping was removed shall be tightly filled with asbestos, mineral wool, or other incombustible insulating material.

6. Sliding Doors

When sliding doors are pocketed in partitions, such pockets shall be completely firestopped at the top, bottom, and ends.

7. Exterior Cornices

Exterior cornices, built of wood or having wood frames, on rows of buildings shall be either fully firestopped between each building or completely separated.

8. Inspection

No firestopping shall be concealed from view until opportunity has been given the building official to inspect it.

Section 805. SHAFTS

1. Enclosure Required

Shafts passing through space occupied by more than one dwelling unit shall be enclosed with construction having a fire resistance of at least three-fourths hour.

2. Openings

Openings in shafts shall be restricted to those necessary for the purpose of the shaftway. Such openings shall be protected with approved fire doors or other approved protective devices in the case of shafts required to have a definite fire resistance.

3. Connections

The connections of shafts to adjoining construction having a lower fire resistance shall be such that the fire resistance of the enclosure will be maintained.

CHAPTER IX. CHIMNEYS AND FIREPLACES

Section 900. General

Chimneys and fireplaces shall be designed and constructed in accordance with generally accepted good practice, provided that the specific requirements in this chapter shall be observed.

Section 901. Construction of Chimneys

1. Materials

Chimneys shall be of approved masonry or reinforced concrete or of other approved materials.

2. Foundations

Masonry or reinforced-concrete chimneys shall not rest upon or be carried by wood floors, beams, or brackets, nor be hung or supported by metal stirrups from wood construction, but shall be built upon concrete or masonry foundations or reinforced-concrete slabs properly proportioned to carry the load without danger of settlement or cracking. The footings shall be carried below the frost level except when not exposed to frost action.

3. Bonding

Masonry or reinforced-concrete walls of building may form parts of chimneys when the chimney walls are securely bonded into the walls of the building and when the flue is lined with flue lining the same as an independent chimney.

4. Corbeling of Chimneys

Corbeled chimneys shall not be supported by hollow walls, cavity walls, or walls of hollow units. Solid walls supporting corbeled chimneys shall be not less than 12 inches thick, and corbeling shall not project more than 1 inch per course and not more than 6 inches in any case.

The total offset, overhang, or corbel of an independent chimney shall not exceed three-eighths the width of the chimney in the direction of the offset.

5. Height

Chimney height shall be as recommended by the equipment manufacturer but not less than 2 feet above any portion of any structure within 15 feet of a chimney.

6. Brick Chimneys

Brick chimneys shall be built of solid brick. The walls shall be 3¾ inches thick and lined with fire-clay flue lining, except that flue lining may be omitted, provided the walls of the chimney are not less than 8 inches thick.

7. Concrete Chimneys

Concrete for chimneys cast in place shall flow readily, be well rodded, and shall be reinforced vertically and horizontally. The walls shall be at least 3¾ inches thick and shall be lined throughout with fire-clay flue lining.

8. Hollow Masonry Units

Hollow masonry units shall not be used for the walls of an independent chimney, but may be used for chimneys built in connection with exterior walls of buildings built of hollow units, in which case the chimney walls shall be at least 8 inches thick. The chimney walls shall be constructed of two widths of 4-inch hollow units set with broken vertical joints, or they may be built of 4 inches of solid masonry. In either case, the outside wall of the chimney shall be securely bonded into the walls of the building.

9. Solid Concrete Block

Solid concrete block used in chimney construction shall be at least 3¾ inches thick, and blocks enclosing one or more flues shall have suitable reinforcement completely encircling the blocks and well embedded in them.

10. Stone

The walls of chimneys built of sawed or dressed stone in courses, properly bonded at corners and tied with metal anchors, shall be at least 3¾ inches thick. Chimney walls of other stone shall be at least 8 inches thick.

11. Flashing

Connections between chimneys and roofs shall be made with cap and base flashing of sheet metal or other approved material, arranged to allow for any lateral or vertical movement between chimney and roof.

12. Change of Interior Dimensions

No change in the interior dimensions of chimneys shall be made within a distance of 6 inches above or below the rafters or roof joists.

13. Special Types of Chimneys

Chimneys of construction other than covered in the foregoing requirements shall be permitted only when approved by the building official and installed in accordance with regulations issued by him. Approval shall be based on performance in tests that show they are safe and suitable for the service and conditions of installation contemplated.

In such tests the temperature of the flue gas at the level of the middle of the first floor construction above the smoke inlet shall reach 1,400° F within 5 minutes and be maintained at this level for 55 minutes, after which it shall be lowered to 1,000° F within 10 minutes and maintained at this level until the temperature on the outside of the chimney becomes constant, the total test duration not to exceed 8 hours. The average flue gas temperature shall be within 50° F of the prescribed temperature for the first hour and within 25° F for the subsequent period.

For acceptable performance in this test the chimney shall not develop cracks extending through from the outside surface to the inside of the flue and there shall be no spalling or other disruptive effects or any deterioration or disintegration that will affect the stability, safety, or durability of the chimney. If the installation is such that combustible construction or materials are or may come in contact with the chimney, the temperature on the outside of the chimney in the above test shall not rise more than 325° F above initial temperature at the level where flue gas temperatures are taken, as measured under 6- by 6-inch felted asbestos pads 0.4 inch thick weighing not less than 4 nor more than 5½ ounces. The temperature rise on any combustible construction near the chimney shall not exceed 300° F as measured under a sheet of mica about 0.002 inch thick.

Section 902. FLUES

1. Flue Lining

Chimneys built of brick, stone, or other masonry units shall be lined throughout with fireclay flue lining; provided that in chimneys having solid brick walls 8 inches or more thick, the flue lining may be omitted. Flue linings shall be at least five-eighths inch thick, and shall be suitable for the purpose and adapted to withstand high temperatures and the resultant gases from burning fuel. The flue sections shall be set in type A or type B mortar as defined in American Standard Building Code Requirements for Masonry A41.1–1944, approved by the American Standards Association. (See Appendix, par. 705.)

2. Separation

When two or more flues are contained in the same chimney, withes of masonry not less than 3¾ inches thick shall be provided at intervals not exceeding 30 inches horizontally, but not more than two flues without such separation. Where the flue linings are not separated by withes, the joints shall be staggered and the vertical distance between joints in adjoining flue linings shall be not less than 7 inches.

3. Construction

The masonry shall be built around each section of lining as it is placed, and the sections shall be carefully bedded one on the other with mortar. Linings shall start at least 8 inches below the center line of smoke-pipe intakes or, in the case of fireplaces, from the apex of the smoke chamber and shall be continuous the entire height of the flue. No smoke-pipe intake shall be cut into a flu lining already set in place. Flues shall be built as nearly vertical as possible, but in no case at an angle greater than 45 degrees from the vertical. Where flues change direction, the abutting linings at the angle joints shall be cut to fit closely, and at no point shall the cross-sectional area be reduced.

4. Area

The inside effective area of flue linings shall be not less than the area of the smoke outlets on the appliances to which the flue is connected, but not less than one-twelfth the opening for fireplaces. The least dimension of any rectangular flue shall be not less than one-half of the greatest dimension.

For flues serving several gas appliances, the flue area shall be at least equal to the aggregate areas of the appliance outlets.

Single vent flues for storage water heaters, stoves, ranges, and other domestic gas appliances having relatively small gas consumption shall have a flue diameter of at least 3 inches, provided, however, that this shall not apply to gas plates. Such flues, unless enclosed in solid masonry walls, shall be of incombustible material of approved design and thickness, and shall vent through and above the roof.

The diameter of a vent flue serving a gas-fired instantaneous or continuous-flow water heater shall be not smaller than the diameter of the outlet on the appliance to which it is connected.

5. Cleaning

Flues shall be thoroughly cleaned and left smooth on the inside.

Section 903. Fireplaces

1. Use of Firebrick

The walls of fireplaces shall be not less than 8 inches thick, provided that if built of stone or hollow units they shall be not less than 12 inches thick. The faces of such minimum-thickness walls exposed to fire shall be lined with firebrick, soapstone, cast iron, or other suitable fire-resistive material. When lined with at least 4 inches of firebrick, such lining may be included in the required minimum thickness. When the firebrick lining is less than 4 inches thick, such lining shall not be included in the required thickness.

2. Incombustible Hearths

Fireplaces, except when designed and used for approved gas appliances only, shall have hearths of brick, stone, tile, or other approved incombustible material supported on masonry or reinforced concrete. Such hearths shall extend at least 16 inches outside the chimney breast and not less than 8 inches each side of the fireplace opening along the chimney breast. The arches shall be of brick, stone, hollow tile, or other approved masonry at least 4 inches thick. A flat stone or a reinforced-concrete slab may be used to carry the hearth instead of an arch, if it is properly supported and a suitable fill is provided between it and the hearth. The combined thickness of the hearth and supporting arch or slab shall be not less than 6 inches at any point.

CHAPTER X. HEAT APPLIANCES—MOUNTING, CLEARANCES, AND CONNECTIONS

Section 1000. General

Heat appliances shall be designed and installed in accordance with good practice, provided that the specific requirements in this chapter shall be observed.

Section 1001. Mounting

1. Bases

Except as hereinafter otherwise provided, heat appliances shall be mounted on masonry bases not less than 3 inches thick supported on the ground, or they shall be mounted on floors of fireproof construction with incombustible flooring or surface finish, or on trimmer arches supporting hearths as required in this Code for fireplaces, in all cases extending not less than 12 inches beyond such appliances on all sides or to the partitions of the room in which the heater is located.

2. Hearths

Stoves or ranges burning solid fuel, the lower surface of which is a portion of the firebox, shall be set on hearths supported by masonry trimmer arches extending not less than 6 inches on all sides beyond such appliances; provided that when such appliances have legs giving an open air space of not less than 5 inches below the bottom of the appliance, they may be set on sheet metal underlaid with not less than one-fourth inch of asbestos or other equivalent approved incombustible material; and, provided further, that where such appliances have ash boxes under the entire firebox and are set on legs giving an open air space of not less than 5 inches below the bottom of the appliance, they may be set on sheet metal.

3. Clearances for Stoves and Ranges

No stove or range shall be placed within 24 inches from combustible construction nor within 18 inches of combustible supports or combustible base of plastered construction; provided that when such construction is protected by a shield of galvanized or bright sheet metal or other equivalent approved incombustible material extending from the floor to 1 foot above and 1 foot beyond the sides of such appliances, these distances may be reduced one-half. The building official may permit these clearances to be decreased when it has been established by test that lesser distances are safe for a particular stove or range.

4. Clearances for Gas Ranges

Domestic gas ranges shall have a distance between the burners and a combustible floor of not less than 12 inches unless such floors are protected with asbestos board under sheet metal or other equivalent approved incombustible material. The oven back or side of the cooking top shall be not less than 6 inches from combustible material unless such material is protected by approved incombustible material as in the case of burners.

5. Bases for Heating Furnaces

Unless otherwise approved by the building official, hot-air, hot-water, and steam heating furnaces installed on wood-joisted floors or on other combustible construction shall have protective bases of sheet metal or asbestos-cement board. In addition to and above this base, there shall be a hollow masonry base arranged for free air-circulation through it for all coal-fired equipment and for all other equipment not protected by a wet base or which does not have a combustion chamber at least 12 inches above the floor.

6. Clearances for Heating Furnaces

No hot-air, hot-water, or steam heating furnace shall be located nearer than 24 inches in any direction to woodwork or other combustible material or construction, including plaster on combustible base. In the case of furnaces which are enclosed in jackets providing an air space or which are insulated in an approved manner, this distance may be reduced to 18 inches; provided that when combustible material is protected with 3/8-inch gypsum board under 1/8-inch asbestos board, or with 3/4-inch gypsum or portland-cement plaster on metal lath, or with material having equivalent fire resistance this distance may be further reduced to not less than 6 inches. The building official may permit these clearances to be decreased when it has been established by test that lesser distances are safe for a particular type of heater.

Section 1002. SMOKE PIPES

1. Connection With Flue

(*a*) *Connection required.*—Every smoke pipe shall connect with a smoke flue by means of a tight joint.

(*b*) *Number limited.*—Not more than one smoke pipe shall be connected to a flue in any one story. A vent from a gas-burning appliance not exceeding 13 square inches may connect into the same flue as a smoke pipe in each story provided the connection is above the smoke pipe.

(*c*) *Thimbles.*—Thimbles shall be built in at the time the chimney is built. Smoke pipes shall enter chimneys through a fire-clay or metal thimble or flue ring of masonry. Neither the intake pipe nor the thimble shall project into the flue.

2. Passage Through Combustible Construction

(*a*) *Ceilings, floors, roofs.*—No smoke pipe shall pass through a ceiling, floor, or roof construction of combustible material.

(*b*) *Partitions.*—Smoke pipes shall not pass through combustible partitions, unless protected by double metal ventilated thimbles 8 inches larger in diameter than the pipe, or protected by thimbles 4 inches larger in diameter than the pipe with the space between the pipe and the thimble filled solidly with approved incombustible insulating material, or unless protected by a concentric sleeve of diameter 2 inches larger than the pipe with the space between filled solidly with incombustible insulating material and the outside surface of the sleeve distant at least 2 inches from combustible material.

3. Clearances From Combustible Construction

The clear distance in all directions between a smoke pipe and combustible construction, including plaster on a combustible base, shall be not less than 12 inches; provided that this clearance may be reduced one-half when such construction is protected by cement-asbestos board or asbestos millboard not less than one-fourth inch thick or equivalent approved covering extending the full length of the smoke pipe and not less than 12 inches beyond it on both sides, or where plaster is on metal or wire lath. The building official may permit these clearances to be decreased when it has been established by test that lesser distances are safe for a particular installation.

Section 1003. DUCTS

1. Material

Ducts, fittings, and connections in warm-air heating systems shall be made of bright tin, galvanized iron, or other approved incombustible material.

2. Protection

(*a*) *Clearances from combustible construction.*—The clear distance between exposed warm-air ducts leading from the furnace to vertical or wall stacks and combustible construction shall not be less than 1 inch.

(*b*) *Clearances within floors and partitions.*—If the bonnet temperature of a warm-air heating system exceeds 250° F, no warm-air duct shall enter a floor, partition, or other construction of combustible material unless it is at least 6 feet distant in a horizontal direction from the furnace or unless it is covered with asbestos paper or millboard at least one-eighth inch thick or equivalent approved protection. A clearance of not less than five-sixteenths inch shall be maintained between combustible construction and warm-air heating stacks, floor or wall ducts, and their inlets and outlets, and they shall be covered with not less than one thickness of asbestos paper weighing not less than 12 pounds per 100 square feet, or equivalent approved protection.

Section 1004. REGISTERS

1. Setting

If the bonnet temperature of a warm-air heating system exceeds 250° F, registers used in such heating system, placed in woodwork or in combustible floors, shall be surrounded with a border of incombustible material not less than 2 inches wide, securely set in place, or shall be installed in some other approved manner.

2. Register Boxes

If the bonnet temperature exceeds 250° F, floor registers shall be provided with double register boxes of tin or galvanized iron or other approved incombustible material, with an air space of not less than five-sixteenths of an inch between inner and outer boxes; or, where single boxes are used, they shall be insulated from the wood or other combustible material by asbestos paper weighing not less than 12 pounds per 100 square feet and a clear space of not less than five-sixteenths of an inch shall be left from combustible material.

3. One-Pipe Furnaces and Floor Furnaces

Except as may be otherwise required in law, in this section, or in duly promulgated regulations, the Commercial Standard CS99–42, Gas Floor Furnaces, Gravity Circulating Type, and the Commercial Standard CS113–44, Oil-Burning Floor Furnaces Equipped With Vaporizing Pot-Type Burners shall be deemed to be generally accepted good practice for construction and installation of gas- and oil-burning floor furnaces, respectively.

Combustible material enclosing register boxes of wall-register type furnaces shall be insulated from the register box with an incombustible material having a maximum coefficient of heat transmission of 1.0 Btu per square foot per hour per degree of temperature difference for the thickness used.

With the exception of wall-register types of furnaces, floor furnaces shall not be placed closer than 6 inches to the nearest wall. Wall-register types shall not be placed closer than 6 inches to a corner. (See Appendix, par. 1004–3.)

4. Fixed Registers

If the bonnet temperature of a warm-air heating system exceeds 250° F, one register without valve or movable louvers shall be provided in the system.

Section 1005. MECHANICAL-CIRCULATION WARM-AIR SYSTEMS

1. General

Except as may be otherwise provided in law, in this section, or in duly promulgated regulations, the Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating, Air Cooling, and Ventilating Systems as recommended by the National Fire Protection Association, 1942, or the recommendations of the National Warm Air Heating and Air Conditioning Association shall be deemed to be generally accepted good practice in the design and installation of mechanical-circulation warm-air systems. (See Appendix, par. 1005.)

2. Recirculation

The installation of equipment providing the recirculation of air from one dwelling unit to another is forbidden.

3. Return Ducts

No return duct of a mechanical-circulation warm-air system shall be permitted from a kitchen, bathroom, or garage.

Section 1006. STEAM AND HOT-WATER PIPES

1. Clearances From Combustible Construction

Where steam or hot-water pipes pass through combustible floors or partitions, or other combustible construction, there shall be on all sides of the pipe an open space which shall be enclosed at the ends with incombustible material.

2. Pipe Coverings

Coverings or insulation used on steam or hot-water pipes shall be of material of which not more than 8 percent by weight shall be combustible.

Section 1007. APPLIANCES

1. Gas Appliances

(*a*) *General.*—Except as may be otherwise provided in law, in this section, or in duly promulgated regulations, the American Gas Association Approval Requirements for Central Heating Gas Appliances (Z21.13–1945 approved by the American Standards Association) and the American Gas Association Requirements and Recommended Practice for House Piping and Appliance Installation, 1940, shall be deemed to be generally accepted good practice with respect to such appliances. (See Appendix, par. 1007.)

(*b*) *Gas logs.*—No gas log, gas grate, or similar heating appliance shall hereafter be installed except in a fireplace constructed as prescribed by this Code and connected with a smoke flue or an outlet pipe as hereinafter provided.

(*c*) *Gas-fired furnaces.*—Gas-fired steam or hot-water furnaces shall be installed as prescribed in this Code for heat appliances and shall be connected with a smoke flue conforming to this Code.

(*d*) *Water heaters.*—Water heaters shall be connected to smoke flues or outlet pipes as hereinafter provided.

(*e*) *Venting.*—Outlet pipes for venting gas appliances shall be standard cast-iron soil pipe, terra-cotta pipe, or other approved incombustible material, so connected as to prevent leakage at the joints.

Such outlet pipes shall have cross-sectional areas of not less than the aggregate areas of the vent outlets of the appliances connected to them.

Such outlet pipes shall be connected to chimneys or be carried to and through the roof or through an exterior wall to the outer air. When not connected to chimneys, they shall be surmounted by a suitable cap.

Outlet pipes passing through walls, floors, or roofs shall be suitably designed or insulated for the purpose and shall be separated from woodwork or other combustible material by a clearance on all sides of not less than 1 inch. (See Appendix, par. 1007–1 (e).)

(*f*) *Liquefied petroleum gases.*—Except as may be otherwise provided in law, in this section, or in duly promulgated regulations, the Standards of the National Board of Fire Underwriters for Liquefied Petroleum Gases as recommended by the National Fire Protection Association, 1940, shall be deemed to be generally accepted good practice with respect to the use of such gases. (See Appendix, par. 1007.)

2. Oil-Fired Appliances

Except as may be otherwise provided in law, in this section, or in duly promulgated regulations, the Commercial Standards CS75–42, Automatic Mechanical Draft Oil Burners Designed for Domestic Installations; CS104–46, Warm-Air Furnaces Equipped with Vaporizing Pot-Type Oil Burners; and CS101–43, Flue-Connected Oil-Burning Space Heaters Equipped With Vaporizing Pot-Type Burners, promulgated by the United States Department of Commerce through the National Bureau of Standards, and the Standards of the National Board of Fire Underwriters for the Installation of Oil Burning Equipment as recommended by the National Fire Protection Association, 1941, shall be deemed to be generally accepted good practice with respect to such appliances. (See Appendix, par. 1007.)

Natural-draft oil burners shall be installed in accordance with generally accepted good practice.

3. Steam and Hot-Water Boilers

Except as may be otherwise provided in law, in this section, or in duly promulgated regulations, steam and hot-water heating boilers shall conform to the Code for Low-Pressure Heating Boilers, of 1940 with amendments to 1945, of the American Society of Mechanical Engineers. (See Appendix, par. 1007.)

4. Solid-Fuel Appliances

(*a*) *Forced-air furnaces.*—Except as may be otherwise provided in law, in this section, or in duly promulgated regulations, the Commercial Standard CS109–44, Solid-Fuel-Burning Forced-Air Furnaces, promulgated by the

United States Department of Commerce, through the National Bureau of Standards, shall be deemed to be generally accepted good practice for the design and construction of such furnaces.

(*b*) *Automatic stokers.*—Except as may be otherwise provided in law, in this section, or in duly promulgated regulations, the Commercial Standard CS48-40, Domestic Burners for Pennsylvania Anthracite (underfeed type), promulgated by the United States Department of Commerce through the National Bureau of Standards shall be deemed to be generally accepted good practice with respect to the installation of automatic stokers using anthracite. The installation of other types of automatic stokers shall be in accordance with generally accepted good practice. (See Appendix, par. 1007.)

Section 1008. Combustion

Adequate facilities shall be provided for the entrance of air to support combustion in rooms or other spaces enclosing heating appliances, provided that the area of such facilities shall be not less than the outlet area of the appliances.

CHAPTER XI. SAFEGUARDS AGAINST ACCIDENTS[9]

Section 1101. Stairways

All interior stairways, including basement stairways, shall have handrails on at least one side. When 44 inches or more in width, they shall have handrails on both sides.

All stairways other than those serving as required exits shall have a minmium headroom of 6 feet 8 inches measured vertically at the riser.

Section 1102. Steps

Outside steps attached to a dwelling and containing more than three risers shall have at least one handrail, provided that this may be omitted in the case of bulkhead stairs leading to a basement.

Section 1103. Porches and Terraces

Porches and terraces attached to a dwelling and with their floors more than 18 inches above finished grade shall be provided with adequate railings.

The least dimension of porches and terraces shall be 3 feet 6 inches.

CHAPTER XII. ELECTRICAL

Section 1200. General

Electric wiring and electric equipment for light, heat, or power shall conform to generally accepted good practice. Except as may be otherwise provided in law, in this chapter, or in duly promulgated regulations, the National Electrical Code, C1-1947, approved by the American Standards Association, shall be deemed to be generally accepted good practice. (See Appendix, par. 1200.)

Section 1201. Inspections[10]

No electric wiring shall be covered or concealed until it has been inspected and permission to conceal has been given by the building official.

CHAPTER XIII. PLUMBING

Section 1300. General

Plumbing shall conform to generally accepted good practice. Except as may be otherwise provided in law, in this chapter, or in duly promulgated regulations, the provisions contained in the requirements of Emergency Plumbing Standards for Defense Housing issued by the Division of Defense Housing Coordination, 1942, shall be deemed to be generally accepted good practice. (See Appendix, par. 1300.)

Section 1301. Sanitary Fixtures

In every dwelling unit in a multiple dwelling and in every other dwelling unit to which running water and sewerage are available, there shall be provided not less than one water closet, one bathtub or shower, one lavatory, and one kitchen sink. (See Appendix, par. 1301.)

APPENDIX

The information contained in this Appendix is presented to assist in interpreting and enforcing the Code requirements. It includes information on how the various standards to which reference is made in the Code may be obtained, as well as references to useful source material and detailed acceptable methods for meeting the general requirements of the Code. Certain desirable building practices that may be necessary

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[9] See Appendix, par. 1100.

[10] This section applies in localities where electrical inspection is under the jurisdiction of the building official. Where the official is unfamiliar with electrical work, it may be possible to arrange with the electrical inspector of a nearby city to make inspection. Otherwise, it may be possible to have an inspector sent by the state fire marshal or to accept a report of the representative of the local board of fire underwriters.

Insert at p.24, National Bureau of Standards Building Materials and Structures Report BMS107, Building Code Requirements for New Dwelling Construction.

NOTE

Recommended uniform plumbing requirements are being developed by a committee representing industry, labor, and government. These will be of a more comprehensive nature and will supersede the Emergency Plumbing Standards for Defense Housing referred to in Section 1300. Announcement will be made of the availability of the document containing these requirements as soon as it is published.

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as requirements in certain localities because of special conditions are also mentioned.

The system of numbering employed in the Appendix corresponds with that in the Code, the term "Paragraph" being used instead of "Section" as in the Code itself. Thus, Paragraph 500 of the Appendix deals with some aspect of Section 500 in the Code. Since it is not necessary to have Appendix matter for every section in the Code, gaps will be found in the numbering of paragraphs in the Appendix.

Paragraph 100. GENERAL

The address of the American Standards Association, mentioned in the note on page 1, is 70 East Forty-fifth Street, New York 17, N. Y.

Paragraph 102. MATERIALS AND METHODS NOT SPECIFICALLY AUTHORIZED

The clause regarding new materials and methods of construction is based upon recommendations developed by the Sectional Committee on Administrative Requirements for Building Codes, A55, of the American Standards Association.

Paragraph 104. PRIVATE WATER AND SEWAGE-DISPOSAL SYSTEMS

The matter of assuring adequate water supply and sewage disposal, although not customarily dealt with in building codes, is believed to be of major importance. The publications referred to are obtainable from the Superintendent of Documents, Washington 25, D. C., for 10 cents each.

Paragraph 302–1. HEIGHT

Where a dwelling is built on sloping ground, this could be done in such a manner that although the dwelling were 2½ stories in height at the main entrance, the back, extending downward to the finished grade, would provide additional stories which could be used as habitable rooms. The requirement in Section 302–1 is to prohibit such construction where the exterior walls are of wood.

Paragraph 400. LIGHT AND VENTILATION

The American Standard Building Code Requirements for Light and Ventilation A53.1–1946 may be obtained from the American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y., for 45 cents.

The more important features of generally accepted good practice are summarized below.

Habitable Rooms

1. General.—Every habitable room should have one or more windows conforming to the following requirements.

2. Glass Area.—The aggregate glass area of required windows should be not less than one-tenth of the floor area served, except for kitchens which should have not less than one-eighth of such area.

3. Openable Area of Windows.[11]—The aggregate openable area of windows should be not less than 50 percent of the required glass area.

4. Arrangement of Windows.—In habitable rooms, the tops of required windows should be not more than 1 foot below the finished ceiling unless the tops of such windows are at least 6 feet 8 inches above the finished floor; provided that where dormer windows are used in habitable rooms with sloping ceilings, the tops of required windows should be not less than 6 feet above the floor.

When the required glass area is located in only one wall of a habitable room, it should be increased to one-eighth of the floor area if the dimension of the room perpendicular to the plane of the glass is more than 15 feet, or if either adjacent wall of the room is more than 9 feet, measured in the plane of the glass from the side of the window.

Bathrooms and Water-Closet Compartments

1. General.—Every bathroom and every water-closet compartment should have one or more windows conforming to these requirements.

2. Glass Area.—The aggregate glass area of required windows should be not less than one-tenth of the floor area served but not less than 3 square feet.

3. Openable Area of Windows.—The aggregate openable area of required windows should be not less than 50 percent of the required glass area but not less than 3 square feet.

Public Hallways

1. Artificial Light.—Adequate facilities for artificial lighting should be provided.

2. Natural Light.—If natural light is provided in any public hallway, at least one window should be placed at the end of such hallway so that it will adequately light the hallway for its entire length or there should be at least one window for each 50 feet of hallway length or fraction thereof. The aggregate glass area of the window or windows should be not less than one-twentieth of the floor area served.

3. Ventilation.—Every public hallway serving more than four dwelling units per story should be ventilated by one or more windows conforming to these requirements.

4. Openable Area of Windows.—The aggregate openable area of required windows should be not less than 50 percent of the required glass area.

5. Recesses and Returns.—Every recess or return opening off a public hallway, the depth or length of which exceeds twice the width of the hallway, and every part of such hallway that is shut off from any other part by a door or doors, should be deemed a separate hallway.

Public Stairways

1. Artificial Light.—Adequate facilities for artificial lighting should be provided.

2. Natural Light.—If natural light is provided, windows containing glass area at least one-tenth of the horizontal area of the stairway but not less than 10 square feet should be supplied in each story through which the stairway passes.

3. Openable Area of Windows.—The aggregate openable area of required windows should be not less than 50 percent of the required glass area.

Basements and Cellars

1. General.—Every basement or cellar should be provided with one or more windows conforming to these requirements.

2. Glass Area.—The aggregate glass area of required windows should be not less than one-fiftieth of the floor area served, provided that portions containing habitable rooms should conform to the requirements for habitable rooms.

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[11] It is recommended that consideration be given to requiring cross or through ventilation in all dwelling units.

3. Openable Area of Windows.—The aggregate openable area of required windows should be not less than 50 percent of the required glass area.

Permissible Equivalents for Windows

For purposes of natural lighting, skylights, glazing in doors and transoms, and glass block or other light-transmitting panels equivalent in lighting effect to the minimum required glass area of windows may be substituted for such glass area. A stairway of one continuous flight may be lighted by a door on the entrance level having a glass area of not less than 10 square feet.

For purposes of ventilation, skylights, louvers, or transoms located in the exterior walls or roof of the building may be substituted for required openable area of windows to the extent of their open or openable area. Exterior doors facing as required for windows may be counted for ventilation but should not be the sole means for ventilation. Public hallways and public stairways may be ventilated by an approved system of ventilation.

YARDS

1. Rear Yards.—Every dwelling should have a rear yard not less than 20 feet in depth.

In the case of an irregular, triangular, or gore-shaped lot or where the wall of a dwelling is not parallel to the lot line, the required minimum depth of a rear yard may be deemed to be the average depth (measured perpendicular to the building wall), provided that no such rear yard should be less in depth than 15 feet at any point.

In any building occupied for both business and dwelling purposes the rear yard should start at such a level as to serve all habitable rooms.

In computing the depth of a rear yard for any dwelling when the rear of such yard opens on an alley, one-half the width of such alley may be assumed to be a portion of the yard.

2. Side Yards.—Side yards serving habitable rooms should have a width of not less than 4 inches for each foot of height above the average finished grade but not less than 5 feet.

In the case of an irregular, triangular, or gore-shaped lot or where a wall of a dwelling is not parallel to the lot line, the required minimum width of a side yard may be deemed to be the average width (measured perpendicular to the wall of the dwelling), provided that no such side yard should be less in width than 3 feet at any point.

In any building occupied for both business and dwelling purposes, side yards should start at such a level as to serve all habitable rooms facing upon such yards.

3. Unobstructed.—Every yard should be kept free and unobstructed, except for trees, shrubbery, clothes poles, arbors, garden trellises, and similar accessories usual to residence buildings, outhouses, private garages, and stables. Cornices and eaves should project not more than 12 inches into the required dimensions of yards.

Courts

1. Width.—Every outer court serving habitable rooms should have a width of not less than 4 inches for each foot or fraction thereof of the height of the court, but not less than 5 feet.

Every inner court serving habitable rooms should have a width of not less than 1 foot for each 1 foot or fraction thereof of the height of the court, but not less than 10 feet.

Every court required to serve other than habitable rooms should have a minimum width of 3 inches for each foot or fraction thereof of the height of such court, but not less than 5 feet.

In the case of irregular or gore-shaped courts, the required minimum width of the court may be deemed to be the average width provided that no such court should be less than 5 feet at any point.

2. Area.—The area of an outer court serving habitable rooms should be not greater than four times the square of its width.

The area of an inner court serving habitable rooms should be not less than one and one-half times the square of its required width.

3. Unobstructed.—Every court should remain unobstructed for its required width or depth and full height, except that cornices projecting not more than 12 inches into the required width or depth, ordinary window sills or belt courses projecting not more than 4 inches into the required width or depth, and drop awnings, should not be considered obstructions. Clothes poles, uncovered porches, steps, terraces, arbors, garden trellises, and similar accessories should not be prohibited by this requirement.

4. Drainage.—The bottom of every court should be properly graded and drained.

Buildings on the Same Lot

If any dwelling or other structure is placed on the same lot with another building or other structure so that any window of either receives light and ventilation from the space between, the width of such space should be not less than the sum of the widths of the side yards that would be required for each building as described under "Side Yards" above if each building were on a separate lot, but in no case less than 10 feet.

Paragraph 402. SCREENING

Every dwelling that is located in an area in which flies or mosquitoes have not been effectively controlled should have all windows, ventilating openings, and doors to the outside equipped with screens of not less than 16 meshes to the inch. All outside screen doors should open outward and be self-closing.

Paragraph 500. SPACE AND ARRANGEMENT

The American Standard Building Code Requirements for Light and Ventilation A53.1–1946, which contains requirements for space and arrangement, may be obtained from the American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y., for 45 cents.

The more important features of generally accepted good practice are summarized below.

Rooms in dwellings should conform to the following requirements as to minimum area and arrangement.

1. Habitable Rooms.

(*a*) *Minimum Area.*—Habitable rooms, other than kitchens, should be not less than 7 feet wide in at least 90 percent of the area of the room and should contain not less than 70 square feet of gross floor area. At least one room in every dwelling unit should have a floor area of not less than 150 square feet. Rooms used for combined living and dining purposes should have a gross floor area of not less than 160 square feet, and not less than 220 square feet if also used for cooking purposes.

When kitchens serving dwelling units are completely enclosed, the floor area should be not less than 60 square feet and not less than 90 square feet when dining space is included, except that in dwelling units having no bedrooms the floor area of the kitchen should be not less than 50 square feet.

(*b*) *Minimum Height.*—Habitable rooms should have a clear height of not less than 7 feet 6 inches, provided that rooms with sloping ceilings should have a clear height of 7 feet 6 inches in at least one-half their area. In computing the area of rooms with sloping ceilings, all portions less than 5 feet in height should be disregarded.

(*c*) *Rooms Below Finished Grade.*—No room which has less than 50 percent of its height above the average adjoining finished grade should be occupied as a habitable room.

2. Privacy.—In two-family and multiple dwellings access to every dwelling unit should be had without passing through any part of any other dwelling unit. In each dwelling unit access from each bedroom to a bathroom should be had without passing through another bedroom or the kitchen. Access to every habitable room in a dwelling unit should be had without having to pass through a bedroom or bathroom. One bedroom, and when more than one bedroom is provided, at least two bedrooms should have access to a bathroom without passing through another habitable room. No bathroom should open directly into a kitchen,

Paragraph 600. EXITS

The American Standard Building Exits Code A9.1–1946 may be obtained from the American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y., or from the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass., for 1 dollar.

The more important features of generally accepted good practice are summarized below.

Kinds of Exits

Exits should consist of stairways or doorways providing direct exit to a street or to an exterior open space leading to a street. Exterior iron fire escapes should not be considered as required exits.

Distribution of Exits

When a floor has two or more exits, they should be placed as far apart as practicable.

Stairways

1. Aggregate Width.—The aggregate width of stairways serving as exits should be not less than 22 inches for every 30 persons or fraction thereof served by the stairway.

2. Construction.

(*a*) *Materials.*—Stairs and landings of stairways serving as exits should be constructed of incombustible materials. Combustible materials may be used in buildings which are not of fire-resistive construction. Stairways should have solid treads and risers.

(*b*) *Treads and risers.*—Treads and risers of stairs in stairways serving as exits should be so proportioned that the sum of two risers in inches and the width of one tread in inches is not less than 24 nor more than 25, provided that no riser should exceed 7¾ inches and no tread should be less in width than 9½ inches exclusive of nosing.

Winders should not be used.

Treads and risers should be of uniform width and height in any one flight.

The minimum headroom of all required stairways should be 7 feet at every point measured vertically at the riser.

The number of risers in any flight of a required stairway should be not less than three.

(*c*) *Landings.*—No flight of stairs should have a vertical rise of more than 12 feet between floors or landings.

The length and width of landings should be not less than the width of stairways in which they occur.

(*d*) *Handrails.*—Stairways should have enclosing walls or well-secured balustrades or guards on both sides and should be provided with handrails on at least one side. When 44 inches or more in width, they should have handrails on both sides. Handrails should project not more than 3½ inches into the required width of the stairway.

(*e*) *Enclosures.*—No openings except the necessary doorways, and windows opening to the exterior of the building, should be permitted in enclosures of stairways and hallways serving as exits.

In multiple dwellings no closets or storage space should be located under stairs.

Doorways

No doorway serving as an exit should have a width of less than 34 inches.

The aggregate width of exit doorways to the outside of a building from lobbies, hallways, or passageways into which exit stairways discharge should be at least equal to the width of the stairways.

No door of a doorway serving as an exit should open immediately on a flight of stairs but a landing at least the width of the door should be provided between such door and such stairs.

Interior doors which provide access to or from a dwelling unit should not be regarded as exits.

Modifications in Exit Width

There should be no reduction in required exit width along the line of exit travel except as may be specifically permitted.

Obstructions

No fire-extinguishing apparatus or radiator, and no steam or other riser should be placed in an exit or in a hallway leading to an exit unless placed in such a manner as not to interfere with free travel and unless heating apparatus is guarded by substantial metal screens or is otherwise safeguarded from contact with occupants.

Paragraph 700–1. QUALITY OF MATERIALS

Standards and specifications mentioned in Section 700–1 may be obtained from the following sources:

Specifications of the American Society for Testing Materials—American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

Federal Specifications—Superintendent of Documents, Washington 25, D. C.

Standards of the American Standards Association—American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y.

Commercial Standards—Superintendent of Documents, Washington 25, D. C.

Paragraph 702. LOADS

The minimum values for wall and roof loads in Section 702 have been derived by the application of the principles set forth in American Standard Building Code Requirements for Minimum Design Loads in Buildings and Other Structures, A58.1–1945 approved by the American Standards Association, but represent a modification of the minimum values established in that document. The reason for this is the relatively low height of the structures concerned herein and the special problems encountered in connection with combinations of snow and wind loads on sloping roofs, such as are characteristic of many residential structures. Local code committees should obtain information as to wind pressures and snow loads in their particular localities and increase the minimum values where necessary.

The following method may be used to determine the live loads in localities where forces greater than the minimum loads used in the Code are encountered.

Wind Loads

The velocity pressure should be obtained locally, if available, and adjusted to 30 feet height; or may be found on the map on page 21 of A58.1–1945.

In order to obtain the maximum exterior loads on walls—pressure on windward and suction on leeward walls—multiply the velocity pressure for the locality by the factors 0.53 and 0.33, respectively.

Exterior loads normal to roofs should be obtained by multiplying the velocity pressure by the applicable factor in the table below.

	Wind normal to the eaves acting simultaneously on windward and leeward slopes					Wind parallel to the eaves acting on entire roof (flat or any slope)
	20° slope or less	30° slope	40° slope	50° slope	60° slope or more	
Windward side	−0.66	0	0.16	0.33	0.49	−0.66
Leeward side	−.49	−.49	−.49	−.49	−.49	

NOTE.—Positive forces act inward; negative forces act outward. Interpolate for slopes not given.

The interior pressure and suction in a dwelling should be obtained by multiplying the velocity pressure by the factors 0.49 and 0.37, respectively. This is based on an average of 15 percent openings.

The above factors for walls and roofs are based on one-story dwellings; add 20 percent for two-story dwellings.

The dwelling as a whole and any structural element thereof should be designed for interior pressure or suction in addition to the external wind force.

Snow Loads

The maximum recorded snow load for the locality should be determined either locally or by reference to the map on page 18 of A58.1–1945. The recorded snow load should be multiplied by the appropriate factor from the table below to produce the design snow load.

Roof slope	*Factor*
0 to 30°	1.00
40°	.67
50°	.34
60°	.00

NOTE.—Interpolate for slopes not given.

The American Standard Building Code Requirements for Minimum Design Loads in Buildings and Other Structures A58.1–1945 may be obtained from the American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y., for 50 cents, or from the Superintendent of Documents, Washington 25, D. C., under the same title, published by the U. S. Department of Commerce, National Bureau of Standards, as Miscellaneous Publication M179, for 10 cents.

Paragraph 704. FOUNDATIONS

For wood footings and piles, mentioned in Sections 704–4 and 704–5, the recommendations of the American Wood-Preservers' Association may be regarded as generally accepted good practice. The address of the Association is 111 West Washington Street, Chicago 2, Ill.

Paragraph 704–6. FOUNDATION WALLS

The American Standard Building Code Requirements for Masonry A41.1–1944 may be obtained from the American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y., for 50 cents, or from the Superintendent of Documents, Washington 25, D. C., under the same title, published by the U. S. Department of Commerce, National Bureau of Standards, as Miscellaneous Publication M174, for 15 cents.

The more important features of generally accepted good practice are summarized below.

1. *General.*—Foundation walls should be of sufficient strength and thickness to resist lateral pressures from adjacent earth and to support their vertical loads without exceeding the stresses specified in Paragraph 705–3; provided that in no case should their thickness be less than the walls immediately above them, except as provided in "3. Veneered and Cavity Walls," below.

2. *Thickness.*—Foundation walls should be of not less than 12-inch nominal minimum thickness, except as follows:

Solid masonry walls reinforced with at least one ⅜-inch round deformed bar, continuous from footing to top of foundation wall, for each 2 feet of length of the wall, may be of 8-inch nominal thickness.

Solid foundation walls of solid masonry units or of coursed stone that do not extend more than 5 feet below the adjacent finished ground level, and hollow walls of masonry and walls of hollow units that do not extend more than 4 feet below the adjacent finished ground level, may be 8 inches in nominal minimum thickness. These depths may be increased to a maximum of 7 feet with the approval of the building official when he is satisfied that soil conditions warrant such increase. The total height of the foundation wall and the wall supported should not exceed that permitted for 8-inch walls.

Foundation walls of rubble stone should be at least 16 inches thick.

Foundation walls of cast-in-place concrete should be at least 8 inches thick; provided that when supporting one-story structures, and the area within the foundation walls is not excavated, they may be 6 inches thick if the total height of the foundation wall and the wall supported is within the allowable height of 6-inch walls.

3. *Veneered and Cavity Walls.*—Foundation walls of 8-inch nominal thickness and conforming to the provisions of the Code, may be used as foundations for single-family dwellings with walls of brick veneer on frame walls, or with nominal 10-inch cavity walls, provided that the dwelling is not more than 1½ stories in height and the total height of the wall, including the gable, is not more than 20 feet. Foundation walls of 8-inch nominal thickness supporting brick veneer or cavity walls, should be corbeled with solid units to provide a bearing the full thickness of the wall above. The total projection should not exceed 2 inches with individual corbels projecting not more than one-third the height of the unit. The top corbel course should not be higher than the bottom of floor joists and should be a full header course.

Paragraph 705. Masonry

The American Standard Building Code Requirements for Masonry A41.1–1944 may be obtained from the American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y., for 50 cents, or from the Superintendent of Documents, Washington 25, D. C., under the same title, published by the U. S. Department of Commerce, National Bureau of Standards, as Miscellaneous Publication M174, for 15 cents.

The more important features of generally accepted good practice are summarized below.

1. *Mortar.*

(*a*) *Classification.*—Mortar used in masonry construction is classified as follows:

Type	Minimum compressive strength of 2-inch cubes at 28 days (lb/in.^{2})
A	2,500
B	600
C	200
D	75

(*b*) *Proportions.*—Unless the strength classification of the mortar has been otherwise established by test as prescribed in American Standard Building Code Requirements for Masonry A41.1–1944, mortars of the following proportions, with the aggregate measured in a damp and loose condition, may be assumed to meet the strength classification given above.

Mortar type	Proportions by volume		
	Cement	Hydrated lime or lime putty (allowable range)	Aggregate measured in a damp and loose condition
A	1 (portland)	0 to ¼	Not more than 3.
B	1 (portland)	1 to 1¼	Not more than 6.
	1 (masonry FS type II)		Not more than 3.
C	1 (portland)	2 to 2½	Not more than 9.
	1 (masonry FS type I)		Not more than 3.
D	None	1 to 1¼	Not more than 3 parts for each part of cementitious material.

The weights per cubic foot of the materials in mortar are considered to be as follows:

	Weight
Portland cement	94 lb/ft^3.
Masonry cement	Printed on bag.
Hydrated lime	40 lb/ft^3.
Sand, damp and loose	1 ft^3 contains 80 lb of dry sand.

2. *Types of Mortar Required.*—Masonry should be laid in type A, type B, or type C mortar, except as follows:

Type A mortar should be used in nominal 10-inch cavity walls, foundation walls of hollow masonry units, and masonry linings of existing masonry walls.

Type A or type B mortar should be used in footings, foundation walls of solid masonry units, isolated piers, load-bearing or exterior walls of hollow masonry units, hollow walls of masonry, and cavity walls exceeding nominal 10-inch thickness.

Type D mortar may be used in solid masonry walls, other than parapet walls or rubble stone walls, not in contact with the soil and not less than 12 inches thick nor more than 35 feet in height, provided the walls are laterally supported at intervals not exceeding twelve times the wall thickness.

Gypsum partition tile and block should be laid in gypsum mortar. Nonbearing partitions and fireproofing of structural clay tile may be laid in gypsum mortar. Firebrick should be laid in fire clay or air-setting mortar.

Glass block when laid in mortar should be laid in type B mortar.

3. *Allowable Stresses.*—Dwellings or accessory structures should be so designed and constructed that the allowable stresses indicated below are not exceeded. In using these stresses the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts should be taken into account.

Unit	Allowable stress in compression (gross area) for mortar types—			
	A	B	C	D
Brick: [a]	*lb/in.*^{2}	*lb/in.*^{2}	*lb/in.*^{2}	*lb/in.*^{2}
8,000 lb/in.^{2}	400	300	200	100
4,500 to 8,000 lb/in.^{2}	250	200	150	100
2,500 to 4,500 lb/in.^{2}	175	140	110	75
1,500 to 2,500 lb/in.^{2}	125	100	75	50
Solid concrete units:				
Grade A	175	125	80	--------
Grade B	125	100	60	--------
Hollow units	85	70	--------	--------
Cast stone	400	320	250	160
Rubble stone	140	100	80	--------
Ashlar stone:				
Granite	800	640	500	400
Limestone and marble	500	400	325	250
Sandstone	400	320	250	160
Cavity walls:				
Solid masonry units	125	100	--------	--------
Hollow masonry units	60	50	--------	--------
Plain concrete	The allowable stresses should not exceed 25 percent for compression, and 3 percent for tension in extreme fiber in flexure, of the compressive strength of the concrete. When the ratio of height to thickness of structural members of plain concrete exceeds 10, the above percentage for compression shall be reduced proportionately to 18 percent for a ratio of height to thickness of 20.			

[a] Includes other solid units of clay or shale.

4. *Thickness and Height of Walls.*—In dwellings or accessory structures solid masonry or faced masonry bearing walls may be of 8-inch nominal thickness when not over 35 feet in height. Such walls in 1-story single-family dwellings, and 1-story private garages, may be of 6-inch nominal thickness when not over 9 feet in height, provided that when gable construction is used an additional 6 feet is permitted to the peak of the gable.

Solid masonry walls above roof level, 12 feet or less in height, enclosing stairways, elevator shafts, penthouses, or bulkheads, may be of 8-inch nominal thickness and may be considered as neither increasing the height nor requiring any increase in the thickness of the wall below, provided the requirements for allowable stresses are met.

Nonbearing walls of solid masonry may be 4 inches less in thickness than required for bearing walls, but the nominal thickness should be not less than 8 inches except where 6-inch walls are specifically permitted. Nonbearing masonry partitions should not be less than 2 inches in thickness, exclusive of plaster, for a maximum unsupported length of 6 feet and a maximum unsupported height of 9 feet; provided that nonbearing masonry partitions having an unsupported height greater than 9 feet and not more than 12 feet should be 3 inches thick, exclusive of plaster.

The minimum thickness of walls of structural clay tile or hollow concrete masonry units should be not less than that required for solid masonry walls.

The minimum thickness of walls of plain concrete may be 2 inches less than that required for solid masonry walls, but not less than 8 inches, except that 6-inch walls of plain concrete may be permitted where 6-inch walls are specifically permitted for solid masonry walls.

The minimum thickness of walls of stone ashlar should be not less than that required for solid masonry walls.

Rubble stone walls should be at least 16 inches thick.

Cavity walls and hollow walls of solid masonry units should be not less in thickness than required for solid masonry walls, provided that 10-inch cavity walls should not exceed 25 feet in height and no cavity wall or hollow wall of solid masonry units should exceed 35 feet in height.

In cavity walls neither the facing nor backing should be less than 3¾ inches in nominal thickness and the cavity should be not less than 2 inches nor more than 3 inches in width. In cavity walls the facing and backing should be securely tied together with suitable bonding ties of adequate strength. A steel rod three-sixteenths inch in diameter or a metal tie of equivalent stiffness, coated with a noncorroding metal or other approved protective coating should be used for each 3 square feet of wall surface. Where hollow masonry units are laid with the cells vertical, rectangular ties should be used; in other walls the ends of ties should be bent to 90-degree angles to provide hooks not less than 2 inches long. Ties should be embedded in horizontal joints of the facing and backing. Additional bonding ties should be provided at all openings, spaced not more than 3 feet apart around the perimeter and within 12 inches of the opening.

5. *Lateral Support.*—Solid masonry walls should be supported at right angles to the wall face at intervals not exceeding 20 times the nominal wall thickness if laid in type A, B, or C mortar, and not exceeding 12 times the nominal wall thickness if laid in type D mortar.

Walls of structural clay tile or hollow concrete masonry units, and hollow walls of masonry should be supported at right angles to the wall face at intervals not exceeding 18 times the nominal wall thickness.

Cavity walls should be supported at right angles to the wall face at intervals not exceeding 14 times the nominal wall thickness.

Such lateral support may be obtained by cross walls, piers, or buttresses, when the limiting distance is measured horizontally, or by floors and roof when the limiting distance is measured vertically. Sufficient bonding or anchorage should be provided between the wall and the supports to resist the assumed wind force, acting either inward or outward. Piers or buttresses relied upon for lateral support should have sufficient strength and stability to transfer the wind force, acting in either direction, to the ground. When walls are dependent upon floors or roofs for their lateral support, provision should be made in the building to transfer the lateral forces to the ground.

Except for window paneled backs, and permissible chases and recesses, walls should not vary in thickness between their lateral supports. When a change in thickness, due to minimum thickness requirements, occurs between floor levels, the greater thickness should be carried up to the higher floor level.

6. *Piers.*—The unsupported height of piers should not exceed 10 times their least dimension. When structural clay tile or hollow concrete masonry units are used for isolated piers to support beams and girders, the cellular spaces should be filled solidly with concrete or type A mortar and when so constructed the allowable stresses may be increased 25 percent, provided that unfilled hollow piers may be used if their unsupported height is not more than 4 times their least dimension.

Paragraph 706. REINFORCED CONCRETE

The Building Regulations for Reinforced Concrete (ACI 318–41) of the American Concrete Institute, approved as the American Standard Building Regulations for Reinforced Concrete A89.1–1946, may be obtained from the American Concrete Institute, 7400 Second Boulevard, Detroit 2, Mich., for 50 cents.

The more important features of generally accepted good practice are summarized below.

1. *Protection of Reinforcement.*

(*a*) *Footings.*—The reinforcement of footings and other principal structural members in which concrete is deposited against the ground should have not less than 3 inches of concrete between it and the ground contact surfaces.

(*b*) *Structural Members.*—The concrete protective covering for reinforcement at surfaces not exposed directly to the ground or weather should be not less than three-fourths inch for slabs and walls and not less than 1½ inches for beams, girders, and columns. In concrete joist floors in which the clear distance between joists is not more than 30 inches the protection of metal reinforcement should be at least three-fourths inch.

2. *Protection.*—When the temperature of the surrounding air is less than 40° F, the concrete should be heated to between 60° and 90° F, and adequate means should be provided to maintain a temperature of 50° F for not less than 72 hours for normal cement concrete, or 24 hours for high-early-strength concrete, or for as much time as is necessary to insure proper rate of curing of the concrete.

In all concrete structures, concrete made with normal portland cement should be maintained in a moist condition for at least the first 7 days after placing and high-early-strength concrete should be so maintained for at least the first 3 days.

3. *Allowable Stresses.*—For concrete of the grade provided for herein, the allowable stresses in reinforced concrete construction may be taken as follows:

	lb/in.²
Extreme fiber of concrete, in compression (flexure)	900
Concrete in direct compression	500
Concrete in shear	40
Bond between concrete and steel	80
Bond between concrete and approved deformed bars	100
For steel reinforcement, in tension:	
Rail-steel, billet-steel (of intermediate and hard grades), and axle-steel (of intermediate and hard grades)	20, 000
Billet-steel (of structural grade) and axle-steel (of structural grade)	18, 000
Cold-drawn steel wire	[14] 20, 000

[14] May be increased to 30,000 lb/in.² under conditions specified in Building Regulations for Reinforced Concrete (ACI 318–41), of the American Concrete Institute.

4. *Removal of Forms.*—Forms for reinforced concrete should remain in place until the concrete has hardened. Those parts of the forms and shoring that

support structural members should not be removed until such members have acquired sufficient strength to support safely their own weight and such loads as may come upon them during construction operations. All forms and other temporary woodwork which are near to or in contact with the concrete or the soil should be removed when the construction is completed.

Paragraph 707. Reinforced Brick Masonry

The requirements of chapter 9 of the Principles of Brick Engineering, 1943, published by the Structural Clay Products Institute, may be regarded as generally accepted good practice. This document may be obtained from the Structural Clay Products Institute, 1756 K Street N. W., Washington 6, D. C., for $4 a copy (to architects and engineers, $2.50).

Paragraph 708. Steel and Iron

The American Standard Building Code Requirements for Structural Steel (Riveted, Bolted, or Welded Construction) A57.1–1943, may be obtained from the American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y., for 40 cents.

Information about the use of light-gage steel construction (see Sec. 708–2) is obtainable from the American Iron and Steel Institute, 350 Fifth Avenue, New York 1, N. Y.

The Standard Specifications for Steel Joists, of the Steel Joist Institute, may be regarded as generally accepted good practice (see sec. 708–3). These specifications may be obtained from the Steel Joist Institute, 3709 Twenty-fourth Street N. E., Washington 18, D. C.

When field welding of steel joists is permitted (see sec. 708–3), it is recommended that work conform to the requirements of Specification for Structural Steel Welding, No. 22Yb, October 1939, published by the Bureau of Yards and Docks, Navy Department, and obtainable from that Bureau at Washington 25, D. C.

Paragraph 709–1. Wood Construction—General

The Wood Handbook of the United States Department of Agriculture is obtainable from the Superintendent of Documents, Washington 25, D. C., for 50 cents. In it will be found discussion of various matters affecting design, including stresses due to wind loads, impact stresses, shear, compression perpendicular to grain and on surfaces inclined to grain, and methods of determining allowable working stresses for short, intermediate, and long columns.

Under ordinary circumstances, designers and builders may wish to avail themselves of a simple method for determining joist sizes which, while not necessarily offering maximum economy, will conform to the requirements of the Code and can be conveniently applied. Such a method is given under "Maximum Spans of Lumber" below. More accurate computations may be made if desired.

Maximum Spans for Lumber

(*a*) *Joists for Floors and Accessible Attics.*—The maximum clear span in number of feet for floor and ceiling joists of 2-inch nominal thickness, except in inaccessible attics, should not exceed 1½ times the nominal depth of the joists in number of inches when spaced 12 inches center to center, nor 1¼ times when spaced 16 inches center to center, nor 1 time when spaced 24 inches center to center.

(*b*) *Joists for Inaccessible Attics.*—The maximum clear span in number of feet for ceiling joists of 2-inch nominal thickness in inaccessible attics should not exceed 2½ times the nominal depth of the joists in number of inches when spaced 12 inches center to center, nor 2¼ times when spaced 16 inches center to center, nor 2 times when spaced 24 inches center to center.

(*c*) *Rafters.*—The maximum clear span for rafters, measured horizontally from the plate to a point directly beneath the ridge, in number of feet for rafters of 2-inch nominal thickness should not exceed 2 times the nominal depth of the rafters in number of inches when spaced 12 inches center to center, nor 1¾ times when spaced 16 inches center to center, nor one-half times when spaced 24 inches center to center.

Adequate methods of nailing are described in the Wood Handbook and in the following:

- Nail-Holding Power of American Woods, Technical Note No. 236, July 1931.
- General Observations on the Nailing of Wood, Technical Note No. 243, August 1940.
- Nailing Dense Hardwoods, Technical Note No. 247, April 1941.
- Timber Fastenings, Separate Reprint from Wood Handbook.

These four items are obtainable without charge from the Forest Products Laboratory, Madison 5, Wis.

In some cases it may be advantageous to make use of special timber connectors. These are described in the Wood Handbook and in Technical Bulletin 865, March 1944, entitled "Timber Connector Joints—Their Strength and Design," United States Department of Agriculture, Forest Products Laboratory. The latter is obtainable from the Superintendent of Documents, Washington 25, D. C., for 20 cents.

Paragraph 709–2. Sizes of Lumber

Information on American Lumber Standards is to be found in the Wood Handbook of the United States Department of Agriculture, and in Simplified Practice Recommendation R16–39, Lumber: American Lumber Standards for Softwood Lumber, both obtainable from the Superintendent of Documents, Washington 25, D. C., for 50 and 20 cents, respectively.

Paragraph 709–5 (a). Load-Carrying Capacity

Walls constructed with 2- by 4-inch studs of average quality, spaced 16 inches on centers and well tied and braced, constitute one form of construction that will meet the load requirements of the Code. For one-story buildings a stud spacing of 2 feet is adequate.

Paragraph 709–5 (c). Masonry Veneer on Wood Construction

The requirement that a waterproof covering shall be securely attached to the framework of the structure back of the masonry veneer may be regarded as having been complied with when sheathing having an approved water-repellent covering or treatment is used.

Paragraph 709–5 (d). Stucco on Wood Construction

In back-plastered construction, the base for the stucco is attached directly to the studs. Adequate bracing is necessary with this type of construction.

Paragraph 709–5 (h). Framing Over Openings in Bearing Walls

The requirements of Section 709–5 (h) regarding lintels will be met by the formula—

$$L=h\sqrt{\frac{T}{3\frac{1}{4}}\times\frac{50}{P}\times\frac{s}{1200}\times\frac{16}{l}},$$

in which

L=the sought span of the lintel in feet
h=the assumed height of the lintel section in inches
T=the total actual thickness of the member comprising the lintel in inches
P=the total load in pounds per square foot of floor area
s=the permissible stress of the lintel material in pounds per square inch
l=the span of the joists in feet.

For lintels over openings in bearing partitions, the span of the joists shall be taken as the sum of the spans on the two sides of the partition.

Care must be exercised to see that the safe horizontal-shear stress is not exceeded. This is likely to occur whenever the product of the quantities under the radical is less than 1.

The nailing at the ends of lintels may be the same as for headers; but a better construction for heavy vertical loads is to double the studs from the support to the underside of the lintel and, in addition, to nail each end of each lintel member with two twentypenny nails if 2- by 4-inch material is used and with at least three twentypenny nails if 2- by 6-inch material or larger is used.

Paragraph 709–7 (b). HEADERS AND TRIMMERS

Not more than five tail beams should be framed to a header when the trimmers are of the same size as the joists which are of the minimum size and strength permitted by the Code. Six tail beams are permitted when the joists and trimmers are of the next standard height greater or if the trimmers are 25 percent stronger than is required for the joists.

Not more than two tail beams should be framed to the header on each side of the opening when the trimmers are of the same size as the joists which are of the minimum size and strength permitted by the Code. Three tail beams are permitted on each side of the opening if the joists are of the next standard height greater or if the trimmers are 25 percent stronger than are required for the joists. Four tail beams are permitted if the trimmers are both higher and stronger, as given above.

Framing around openings larger than above or details not covered should be designed by a competent engineer.

The tail beams of 2-inch thickness in ordinary dwellings, when 6 inches or more in height and supported by nails, should have not less than three twentypenny nails through the first header into each tail beam nor less than one twentypenny nail for each 4 square feet of floor supported by the tail beam. The second header should be nailed through the first header into the tail beam by not less than two-thirds as many twentypenny nails as were required in nailing the first header to the tail beam.

The headers should be nailed to the first trimmer by not less than three twentypenny nails through the first trimmer into each end of each header. The total number of nails into each end of the header, through the first trimmer, should be not less than one for each 8 square feet of floor supported by the tail beams. The second trimmer should be nailed through the first trimmer and into the headers with not less than two-thirds as many nails as are required for the first trimmer to the header.

Toe nailing or other means of support may be substituted for the direct nailing given above provided it has at least the strength and rigidity offered by the required nailing given above.

Paragraph 709–7 (c). SUPPORT OF RAFTERS

The minimum size of collar beams should be 1 inch by 6 inches or 2 by 4 inches, with maximum spacing of 5 feet. When ceiling joists do not serve as a tie at the plate line, ceiling joists or other ties on each pair of rafters are necessary somewhere below the upper third and they should be well spiked to each rafter. Special provision for tying the lower ends of the rafters to the floor or wall construction should also be made.

Paragraph 709–7 (d). BRIDGING

A line of bridging should be provided at all supports where adequate stiffening is not otherwise provided.

Paragraph 709–8. PLANK-AND-BEAM CONSTRUCTION

In addition to the specific requirements of Section 709–8, the following procedure should be observed:

When beams are built of two or more laminations, all laminations should be securely spiked together from both outside faces. Each end of each lamination should bear on a support. When beam laminations are spaced to allow passage of utilities or for other reasons, they should be blocked at frequent intervals at each space between laminations and each lamination should be securely nailed to the blocking.

To avoid undue contraction after laying, plank should be protected from the elements during storage and construction.

Finish flooring, when used, should be not less than thirteen-sixteenths inch thick and should be laid at right angles with the plank of the subfloor over building paper or felt.

In two-story plank-and-beam construction, the studs at the second floor should be cut and capped with a plate to provide bearing for second-floor beams. Solid blocking or fillers whose depth is equal to that of the second-floor beam should be provided between beams and members of spaced beams at the exterior wall. The studs should bear on a plate laid on the plank flooring which extends to the outside wall.

Solid or built-up posts supporting beams should be squared at both ends to provide full bearing.

Plank-and-beam construction may be used for the first floor in conjunction with conventionally framed second floors, roofs, or ceilings. Where conventional joist framing is used above the first floor, the requirements already set forth for framed construction should apply.

When joisted construction is used in the second floor in conjunction with plank-and-beam construction in the first floor, bearing partitions should be placed directly over beams whose section has been increased sufficiently to carry the additional load; or special framing, either within the bearing partition or in the supporting floor system, should be provided to carry the additional load.

Interior columns should be designed to support adequately their loads, and the column ends should be squared to provide uniform bearing for the beams. Provision should be made for adequate bearing under beams by suitable column dimensions, suitable corbels or caps, by notching the columns, or by spiking bearing blocks not less than 2 feet long to the sides of the column.

Paragraph 709–9 (a). PLYWOOD CONSTRUCTION—MATERIAL

Commercial Standard CS45–45 Douglas Fir Plywood, is obtainable from the Superintendent of Documents, Washington 25, D. C., for 10 cents.

A revision of Commercial Standard CS35–42, Plywood (Hardwood and Eastern Red Cedar) is expected to be published in the near future. When it is issued, it would be desirable to amend the second and third paragraphs of Section 709–9 (a) of the Code to include it as an additional reference document, as follows:

Plywood to be exposed to the weather or to severe conditions of service shall meet the requirements established for "Exterior Type" in Commercial Standard CS45–45, Douglas Fir Plywood or for type I in Commercial Standard CS35—, Hardwood Plywood. (See Appendix, par. 709–9 (a).)

Plywood for interior use above grade and not subjected to severe conditions of service shall meet the requirements established for the "Moisture Resistant Type" in Commercial Standard CS45–45, Douglas Fir Plywood or for types II or III in Commercial Standard CS35—, Hardwood Plywood. (See Appendix, par. 709–9 (a).)

The publication CS35—, Hardwood Plywood, when issued, may also be obtained from the Superintendent of Documents, Washington 25, D. C.

Paragraph 709–9 (b). GLUING PLYWOOD TO FRAMING MEMBERS

Army Air Force Specifications 14124–A, Glue; Low-temperature-setting resin (phenol, melamine, and resorcinol base); 14139, Glue; High-temperature-setting resin (phenol, melamine, and resorcinol base); and 14122, Glue; Water- and mold-resistant casein are obtainable from Army Air Forces, Wright Field, Dayton, Ohio.

Federal Specification C–G–456; Glue casein type, water-resistant is obtainable from the Superintendent of Documents, Washington 25, D. C., for 5 cents.

Paragraph 709–9 (c). DESIGN OF FLAT PANEL WITH STRESSED COVERINGS

The safe stress and methods of calculating the stress in a flat panel with stressed covering as given below apply only to panels with plywood covering glued to longitudinal wood members.

(1) *Construction Features.*—The gluing between the frame and plywood covers and also between plywood laminations should be good.[15]

The longitudinal members should be at least twice as thick (cross-sectional dimension next to the covering) as the thicker covering.

Headers must be provided with longitudinal members whose ratio of height to thickness is 2 or more.

(2) *Strength and Stiffness.*—In calculating the strength and stiffness of a plywood panel, any clear width of covering in excess of b between any two longitudinal members should be neglected. Panels with a clear distance between longitudinal members over $2b$ should not be considered as having stressed covering. The value of b shall be determined by the formulas

For three plies:

$$b=31h\sqrt{\frac{h}{\text{parallel plies thickness}}},$$

For five or more plies:

$$b=36h\sqrt{\frac{h}{\text{parallel plies thickness}}},$$

where b is the basic width between longitudinal members in inches (clear distance, not center to center) and h is the thickness of plywood cover in inches. With b determined for plywood as above, the strength and stiffness of the panel should be determined from the strength values for clear wood given in the Wood Handbook. (See par. 709–1.) First calculate the moment of inertia of the section, neglecting the cross plies and all covering in excess of b. Then calculate the stiffness, using the modulus of elasticity for the species taken from the Wood Handbook. In calculating the safe strength for spacing of longitudinal members one-half b or less, use for high-grade plywood on the compressive face 85 percent, and for a medium grade of plywood 75 percent, of the basic stress in compression parallel to the grain, increased when used in a continuously dry location by 25 percent.

When the clear distance between the longitudinal members is greater than one-half b, reduce the stress uniformly from that allowed at one-half b to two-thirds this amount at a spacing of b.

In calculating the strength on the tension face, use the basic stress in extreme fiber in bending, from the Wood Handbook, and proceed as above.

Paragraph 709–10. TERMITES AND DECAY

Provisions for ventilation beenath buildings in the first edition, retained here, were suggested by the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture. Additional information will be found in Prevention and Control of Decay in Dwellings, Technical Note No. 251, issued by the Division of Forest Pathology of the United States Department of Agriculture, 1941, and obtainable without charge from the Forest Products Laboratory, Madison 5, Wis.

For further information on methods of guarding against termites, see "Insects in Relation to National Defense," Circular 2 and Supplement A thereto, issued in February and June 1941 by the Bureau of Entomology and Plant Quarantine and obtainable without charge from that Bureau, United States Department of Agriculture, Washington 25, D. C.

Precautions should be taken to guard against excessive moisture content caused by conditions during delivery and installation.

The more decay-resistant species mentioned in Section 709–10 (g) include baldcypress, redwood, and cedar.

Paragraph 710. REINFORCED GYPSUM CONCRETE

The American Standard Building Code Requirements for Reinforced Gypsum Concrete A59.1–1945 is obtainable from the American Standards Association, 70 East Forty-fifth Street, New York 17, N. Y., for 25 cents.

Paragraph 800. FIRE PROTECTION—GENERAL

The standard referred to in Section 800 is obtainable from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., for 25 cents.

Paragraph 801. FIRE SEPARATION

In Section 801 and elsewhere in the Code, certain fire-resistance requirements for walls or partitions separating dwellings or dwelling units are given. For specific materials and thicknesses which will meet these requirements, reference should be made to publications on the subject, which include the following:

BMS71 Fire Tests of Wood- and Metal-Framed Partitions.

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[15] It is essential to have good gluing between the frame and the covering, and it is almost equally important to have good bond and strength within the covering.

BMS92 Fire-Resistance Classifications of Building Constructions.

These publications are issued by the National Bureau of Standards and are obtainable from the Superintendent of Documents, Washington 25, D. C., for 20 and 25 cents, respectively. Additional information on fire resistance of various structural members is being developed through research at the National Bureau of Standards. Inquiries concerning this should be addressed to the Bureau at Washington 25, D. C.

Paragraph 802–1. Clearance from Chimneys

Masonry chimneys, unless integral with a masonry wall, are generally built later than walls and interior construction. With interior wood framing the joists and rafters are cut and headers framed in to give an opening for the chimney so it will clear the wood by 2 inches or more. The chimney may not come exactly in the intended location but the framing, if necessary, should be modified to give a free space between it and the chimney. While the rough flooring is usually cut back to the border of the opening, the finish floor must cover the opening and, without other provisions seldom applied, must also serve to support the chimney laterally at the floor lines. These purposes can be served by placing the finish flooring in contact with the chimney for not more than 3 inches each way at the corners and away from it by about one-half inch over the rest of the perimeter where somewhat higher surface temperatures would be expected.

Preferably no combustible grounds for plaster or strips for attachment of trim should be placed against a chimney wall and if used should be in locations near the corners. No wood nailing plugs should be placed in the masonry joints of chimneys. Wood baseboards and other combustible trim should not be placed in contact with unplastered chimneys.

The space between the chimney and wood floor or roof framing should not be filled except partially as needed for firestopping around the chimney. This can be accomplished with mortar or plaster about 1 inch thick held by strips of metal lath or wire fabric secured in the opening.

Paragraph 804–1. Firestopping—General

It is desirable that firestopping in partitions between dwelling units should be incombustible.

Paragraph 1000. Heat Appliances—Mounting, Clearances, and Connections

In localities where weather conditions make it justifiable, a provision might well be included to the effect that appliances capable of heating habitable rooms to a temperature of 70° F at all times shall be provided.

Paragraph 1004–3. One-Pipe Furnaces and Floor Furnaces

The Commercial Standards mentioned in Section 1004–3 are obtainable from the Superintendent of Documents, Washington 25, D. C., CS99–42 for 5 cents and CS113–44 for 10 cents.

Floor and wall furnaces of the above types have, in general, considerably higher outlet temperatures than other standard types of warm-air heating equipment. This condition makes possible a greater hazard to persons in the occurrence of burns and to combustible material through the ignition of clothing, furniture, or other combustibles that may come into contact with the outlet grate.

Paragraph 1005. Mechanical Circulation Warm-Air Systems

The standards of the National Board of Fire Underwriters mentioned in Section 1005–1 are obtainable from that organization at 85 John Street, New York 7, N. Y.

The Practical Code for the Design and Installation of Mechanical Warm Air Heating Systems, applicable only to the average small installation, and the Technical Code for the Design and Installation of Mechanical Warm Air Heating Systems, both issued in June 1940 by the National Warm Air Heating and Air Conditioning Association, are obtainable from the Association, 145 Public Square, Cleveland 14, Ohio.

Paragraph 1007. Appliances

The requirements mentioned in Section 1007–1 (a) are obtainable from the American Gas Association, 420 Lexington Avenue, New York 17, N. Y., for $1.00 and 50 cents, respectively. It will be found that in some cases these will be supplemented by other standards of the American Gas Association applying to particular appliances. Reference should also be made to these standards when necessary.

NBFU Pamphlet No. 58, containing the standards mentioned in Section 1007–1 (f), is obtainable from the National Board of Fire Underwriters, 85 John Street, New York 7, N. Y.

The code mentioned in Section 1007–3 is obtainable from the American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York 18, N. Y., for 75 cents, with a twenty percent discount to ASME members.

Information concerning Commercial Standards may be obtained from the National Bureau of Standards, Washington 25, D. C. The Commercial Standards mentioned in Section 1007–2 and in Section 1007–4 are obtainable from the Superintendent of Documents, Washington 25, D. C., as follows:

CS48–40, Domestic Burners for Pennsylvania Anthracite (underfeed type), 5 cents.
CS75–42, Automatic Mechanical Draft Oil Burners Designed for Domestic Installations, 10 cents.
CS101–43, Flue-Connected Oil Burning Space Heaters Equipped With Vaporizing Pot-Type Burners, 10 cents.
CS104–46, Warm Air Furnaces Equipped With Vaporizing Pot-Type Oil Burners, 10 cents.
CS109–44, Solid-Fuel-Burning Forced-Air Furnaces, 10 cents.

Paragraph 1007–1 (e). Venting

The requirements of Section 1007–1 regarding venting will be met by the use of type A and type B flues for the respective appliances as described in Section 1105 of the 1943 edition of the Building Code recommended by the National Board of Fire Underwriters, obtainable from that organization at 85 John Street, New York 7, N. Y.

For examples of acceptable forms of vent piping other than those mentioned in Section 1007–1 (e), reference may be made to pages 33 and 34 of the November 1945 List of Inspected Gas, Oil, and Miscellaneous Appliances of Underwriters' Laboratories, Inc., 161 Avenue of the Americas, New York 13, N. Y.

Paragraph 1100. SAFEGUARDS AGAINST ACCIDENTS

For further information on measures tending to reduce hazards in and about dwellings, see Principle 29, of Basic Principles of Healthful Housing, Second Edition, May 1939. This report of the Committee on the Hygiene of Housing of the American Public Health Association, 1790 Broadway, New York 19, N. Y., is obtainable from the Association for 25 cents.

Paragraph 1200. ELECTRICAL—GENERAL

The National Electrical Code is obtainable from the National Board of Fire Underwriters, 85 John Street, New York 7, N. Y., for 5 cents.

Paragraph 1300. PLUMBING—GENERAL

Emergency Plumbing Standards for Defense Housing is obtainable from the Superintendent of Documents, Washington 25, D. C., for 10 cents.

Paragraph 1301. SANITARY FIXTURES

For further information on sanitary fixtures, see Part VIII of Emergency Minimum Sanitation Standards, 1943, reprint No. 2529 from the Public Health Reports, obtainable from the Superintendent of Documents, Washington 25, D. C., for 10 cents.

RATPROOFING

In localities where it is established that rats exist in sufficient numbers to constitute a health hazard, code requirements concerning ratproofing are justified. For information on this subject see Principle 21, of Basic Principles of Healthful Housing, Second Edition, May 1939, a report by the Committee on Hygiene of Housing of the American Public Health Association, 1790 Broadway, New York 19, N. Y. The report (now being reprinted) will be obtainable from the Association for 40 cents.

NOISE

Although no specific requirements regarding noise are contained in the Code, it is recognized that measures to exclude or reduce excessive noise are desirable. Such measures are discussed in Principle 7, of Basic Principles of Healthful Housing, Second Edition, May 1939, a report by the Committee on the Hygiene of Housing, American Public Health Association, 1790 Broadway, New York 19, N. Y. The report (now being reprinted) will be obtainable from the Association for 40 cents. Ultimately, these measures may find their way into mandatory requirements, but for the present they are cited merely as good practice.

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BMS33	Plastic Calking Materials	15¢
BMS34	Performance Test of Floor Coverings for Use in Low-Cost Housing: Part 1	10¢
BMS35	Stability of Sheathing Papers as Determined by Accelerated Aging	*
BMS36	Structural Properties of Wood-Frame Wall, Partition, Floor, and Roof Constructions with "Red Stripe" Lath Sponsored by The Weston Paper and Manufacturing Co.	10¢
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BMS40	Structural Properties of a Wall Construction of "Knap Concrete Wall Units" Sponsored by Knap America, Inc.	10¢
BMS41	Effect of Heating and Cooling on the Permeability of Masonry Walls*	*
BMS42	Structural Properties of Wood-Frame Wall and Partition Constructions with "Celotex" Insulating Boards Sponsored by The Celotex Coporation	15¢
BMS43	Performance Test of Floor Coverings for Use in Low-Cost Housing: Part 2	15¢
BMS44	Surface Treatment of Steel Prior to Painting	10¢
BMS45	Air Infiltration Through Windows	15¢
BMS46	Structural Properties of "Scot-Bilt" Prefabricated Sheet-Steel Constructions for Walls, Floors, and Roofs Sponsored by The Globe-Wernicke Co.	10¢
BMS47	Structural Properties of Prefabricated Wood-Frame Constructions for Walls, Partitions, and Floors Sponsored by American Houses, Inc.	10¢
BMS48	Structural Properties of "Precision-Built" Frame Wall and Partition Constructions Sponsored by the Homasote Co.	15¢
BMS49	Metallic Roofing for Low-Cost House Construction	10¢
BMS50	Stability of Fiber Building Boards as Determined by Accelerated Aging	10¢
BMS51	Structural Properties of "Tilecrete Type A" Floor Construction Sponsored by the Tilecrete Co.	10¢
BMS52	Effect of Ceiling Insulation Upon Summer Comfort	10¢
BMS53	Structural Properties of a Masonry Wall Construction of "Munlock Dry Wall Brick" Sponsored by the Munlock Engineering Co.	10¢
BMS54	Effect of Soot on the Rating of an Oil-Fired Heating Boiler	10¢
BMS55	Effects of Wetting and Drying on the Permeability of Masonry Walls	10¢
BMS56	A survey of Humidities in Residences	10¢
BMS57	Roofing in the United States—Results of a Questionnaire	*
BMS58	Strength of Soft-Soldered Joints in Copper Tubing	10¢
BMS59	Properties of Adhesives for Floor Coverings	10¢
BMS60	Strength, Absorption, and Resistance to Laboratory Freezing and Thawing of Building Bricks Produced in the United States	15¢
BMS61	Structural Properties of Two Nonreinforced Monolithic Concrete Wall Constructions	10¢
BMS62	Structural Properties of a Precase Joist Concrete Floor Construction Sponsored by the Portland Cement Association	10¢
BMS63	Moisture Condensation in Building Walls	15¢
BMS64	Solar Heating of Various Surfaces	10¢
BMS65	Methods of Estimating Loads in Plumbing Systems	15¢
BMS66	Plumbing Manual	*
BMS67	Structural Properties of "Mu-Steel" Prefabricated Sheet-Steel Construction for Walls, Partitions, Floors, and Roofs Sponsored by Herman A. Mugler	15¢
BMS68	Performance Test for Floor Coverings for Use in Low-Cost Housing: Part 3	15¢
BMS69	Stability of Fiber Sheathing Boards as Determined by Accelerated Aging	10¢
BMS70	Asphalt-Prepared Roll Roofings and Shingles	15¢
BMS71	Fire Tests of Wood- and Metal-Framed Partitions	20¢
BMS72	Structural Properties of "Precision-Built, Jr." Prefabricated Wood-Frame Wall Construction Sponsored by the Homasote Co.	10¢
BMS73	Indentation Characteristics of Floor Coverings	10¢
BMS74	Structural and Heat-Transfer Properties of "U. S. S. Panelbilt" Prefabricated Sheet-Steel Constructions for Walls, Partitions, and Roofs Sponsored by the Tennessee Coal, Iron & Railroad Co.	15¢
BMS75	Survey of Roofing Materials in the North Central States	15¢
BMS76	Effect of Outdoor Exposure on the Water Permeability of Masonry Walls	15¢
BMS77	Properties and Performance of Fiber Tile Boards	10¢
BMS78	Structural, Heat-Transfer, and Water-Permeability Properties of Five Earth-Wall Constructions	20¢
BMS79	Water-Distributing Systems for Buildings	15¢
BMS80	Performance Test of Floor Coverings for Use in Low-Cost Housing: Part 4	15¢
BMS81	Field Inspectors' Check List for Building Constructions (cloth cover, 5 x 7½ inches)	20¢

* Out of print.

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BUILDING MATERIALS AND STRUCTURES REPORTS

[Continued from cover page III]

BMS82	Water Permeability of Walls Built of Masonry Units	20¢
BMS83	Strength of Sleeve Joints in Copper Tubing Made With Various Lead-Base Solders	10¢
BMS84	Survey of Roofing Materials in the South Central States	15¢
BMS85	Dimensional Changes of Floor Coverings With Changes in Relative Humidity and Temperature	10¢
BMS86	Structural, Heat-Transfer, and Water-Permeability Properties of "Speedbrik" Wall Construction Sponsored by the General Shale Products Corporation	15¢
BMS87	A Method for Developing Specifications for Building Construction—Report of Subcommittee on Specifications of the Central Housing Committee on Research, Design, and Construction	15¢
BMS88	Recommended Building Code Requirements for New Dwelling Construction With Special Reference to War Housing	*
BMS89	Structural Properties of "Precision-Built, Jr." (Second Construction) Prefabricated Wood-Frame Wall Construction Sponsored by the Homasote Co	15¢
BMS90	Structural Properties of "PHC" Prefabricated Wood-Frame Constructions for Walls, Floors, and Roofs Sponsored by the PHC Housing Corporation	15¢
BMS91	A Glossary of Housing Terms	15¢
BMS92	Fire-Resistance Classifications of Building Constructions	30¢
BMS93	Accumulation of Moisture in Walls of Frame Construction During Winter Exposure	10¢
BMS94	Water Permeability and Weathering Resistance of Stucco-Faced, Gunite-Faced, and "Knap Concrete-Unit" Walls	10¢
BMS95	Tests of Cement-Water Paints and Other Waterproofings for Unit-Masonry Walls	15¢
BMS96	Properties of a Porous Concrete of Cement and Uniform-Sized Gravel	10¢
BMS97	Experimental Dry-Wall Construction With Fiber Insulating Board	10¢
BMS98	Physical Properties of Terrazzo Aggregates	15¢
BMS99	Structural and Heat-Transfer Properties of "Multiple Box-Girder Plywood Panels" for Walls, Floors, and Roofs	15¢
BMS100	Relative Slipperiness of Floor and Deck Surfaces	10¢
BMS101	Strength and Resistance to Corrosion of Ties for Cavity Walls	10¢
BMS102	Painting Steel	10¢
BMS103	Measurements of Heat Losses from Slab Floors	10¢
BMS104	Structural Properties of Prefabricated Plywood Lightweight Constructions for Walls, Partitions, Floors, and Roofs Sponsored by the Douglas Fir Plywood Association	25¢
BMS105	Paint Manual	$1.00
BMS106	Laboratory Observations of Condensation in Wall Specimens	10¢
BMS107	Minimum Requirements for New Dwelling Construction	20¢

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* Out of print.